

GEORGIA TECH
TECHNOLOGY TRANSFER CENTER

FINAL REPORT
FIFTH YEAR CONTRACT
MARCH, 1988

GEORGIA INSTITUTE OF TECHNOLOGY

A Unit of the University System of Georgia
Atlanta, Georgia 30332



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SCHOOL OF CIVIL ENGINEERING
GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GA 30332

ABSTRACT

As the final report for the fifth year contract, this summary will document the activities of the Georgia Tech Technology Transfer Center during that year. Tallies and summaries will be provided concerning the workshops, newsletters, mailing list, and video tape library, as well as the distribution of technical publications and assistance. In addition, this report will evaluate these activities with a view to the progress of the Center.

In brief, the Center maintains a mailing list of over 1700 entries, a publication list of 230 entries, and a video tape library containing thirty-eight tapes. Documentation on each of these lists is contained in the appendix. Also, the Center has sponsored twenty-two workshop sessions, with a total attendance of 648 persons. As a result of instating a policy of charging a registration fee for workshops, the Center has received \$10,730. Regarding the newsletter, the Center distributed approximately 2050 copies each quarter (Copies of each newsletter are found in the appendix.).

The evaluation of the Center's fifth year activities are based primarily on the results of interviews conducted by Mr. Grover Bowman with officials throughout the state. Mr. Bowman was employed by the Center in December of 1987 to conduct these interviews in order to evaluate the services offered by the Center and the local agencies' awareness of these services.

Evaluation indicates that the Center continues to increase its effectiveness in assisting local agencies with transportation needs. In addition, suggestions are made as to how the Center's services could be even more applicable and specific for individual locales.

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INTRODUCTION

The Georgia Tech Technology Transfer Center was established to bridge the gap between research and implementation in the area of roadways, bridges, and transit. The Center achieves this goal by encouraging awareness and implementation of effective procedures, practices, and materials at local levels. In doing so, the Center seeks to enhance communication with and programs provided by the Georgia Department of Transportation.

The GDOT has divided the 159 counties in the State into seven districts. Some of the district staff that the Center deals with includes the District Engineer, Maintenance Engineer, Construction Engineer, Traffic Engineer, and Training Officer. During the years, a strong working relationship has developed between the local agency staff and the GDOT. Most of the technical assistance received by the local agencies comes through GDOT, and it is this route of assistance that the Technology Transfer Center seeks to tap into and expand upon.

When the Center started its operation, it quickly realized the advantage of using the GDOT relationship with the local jurisdictions as a vehicle to get the program underway and to begin to establish credibility. The efforts of the Center are coordinated with those of the GDOT through the District Engineers, GDOT liaison (Mr. Sam Vollo), and with other GDOT Engineers. Further, work with the Federal Highway Administration is coordinated through the FHWA liaison (Mr. Andy Hughes) and other FHWA staff.

Center activities are monitored by two committees. These committees are the Technical Advisory Committee and the Policy Advisory Committee. The Technical Advisory Committee is composed of Mr. Andy Hughes (FHWA), Mr. Sam Vollo (GDOT), and Dr. John Moskaluk (Georgia Tech). The prime function of this committee is to oversee the daily activities of the Center and to provide guidance to the Center Director.

The Policy Advisory Committee is composed of Commissioner Hal Rives (GDOT), Mr. Peter Malphrus (GDOT), Mr. Louis Papet (FHWA), Mr. Erwin Kee (FHWA Advisory), Mr. Jerry Griffin (Association County Commissioners), Mr. James Burgess (Georgia Municipal Association), Dr. Edmund

Fitzgerald (Georgia Tech), and the Technical Advisory Committee. The function of this committee is to provide policy guidance to both the Technical Advisory Committee and to the Center Director. The committee deals with the broad issues concerning center strategy as well as specific issues such as workshop topics.

At the present time, the Center staff consists of John Moskaluk, Center Director, and his assistant, Marty Milliner, as well as a part-time student, Jeff Bump.

CENTER ACTIVITIES

Mailing List

The mailing list contains over 1700 entries and can be sorted by agency type, GDOT district, or employee type.

Included on the mailing list are Street Superintendents, City and County Engineers, City and County Maintenance Personnel, Law Enforcement Officials, County Commissioners, Area Planning and Development Commissions (APDC's), State Legislators, City Mayors, County Road Advisors, Georgia DOT District Engineers and Training Officers, Federal Coordinators, Technology Transfer Centers, and others.

The mailing list is updated when changes in personnel are made available to the Center and also by request. Workshop participants are encouraged to have their name added to the mailing list, and many do so. A copy of the mailing list is included in the appendix.

Publication List

The software for the IBM-PC which was developed by the Center staff to maintain, revise, and print the mailing list has been improved to include the Center's publication list. This list currently includes 230 publications and can be sorted by subject and author. A listing of the publications currently available from the Center is contained in the appendix.

Publications are distributed in two ways. During seminars and workshops, publications related to the subject area are provided for each participant. A total of 1598 publications were distributed in this manner. Also, publications are sent by request to local officials. As a result of such requests, 262 publications were mailed out.

Video Tape Library

The Center is currently in the process of building a video tape library. At the present time, the Center has thirty-eight VHS video tapes which may be borrowed for a two-week period (requests are usually limited to two tapes at a time). The tapes are loaned free of charge to

anyone who requests them. Updates on available tapes are made in the newsletter. Certain tapes are very popular, and a waiting list is maintained for the distribution of tapes which were unavailable at the time of the request. A current listing of the tapes available and their synopses is included in the appendix.

Workshops

Workshops are the most important of the Center's activities, in terms of both the quality and the quantity of access to the local agencies. Therefore, before a workshop is implemented, discussions are held with local officials, GDOT, FHWA, and others to evaluate topics of potential benefit to local agencies. The Policy Advisory Committee uses this information as well as returned questionnaires from previous workshops to determine which workshops should be scheduled and the locations for their presentations.

Workshop instructors are chosen from GDOT, FHWA, local agencies, and consultants. Most frequently, instructors are GDOT personnel.

The criteria used in making each of the above decisions are shown below:

DECISION

- Workshop topic
- Duration
- Schedule
- Instructors

CRITERIA

- Potential benefits
- Needs
- Maximum participation
- Maximum participation
- Efficient coverage
- Maximum participation
- Knowledge of subject
- Understanding of local agency needs
- Cost

Fifteen workshop sessions were held during the last year with a total attendance of 363 persons. The following is a summary of workshop attendance:

WORKSHOP TITLE

PARTICIPANTS

Surface Treatment	
Atlanta	2/3
Macon	2/4

26
32

Tifton	2/5	18
Cartersville	5/5	<u>17</u>
Total		93
NACE Workshop		
Atlanta	4/9-4/10	34
Roadway Application of Geotextiles		
Atlanta	8/4	29
Macon	8/5	7
Tifton	8/6	<u>11</u>
Total		47
Traffic Engineering Applications of Microcomputers		
Gainesville	10/13	10
Thomaston	10/21	10
Tennille	10/22	9
Jesup	10/28	21
Chamblee	11/4	15
Chamblee	11/5	<u>15</u>
Total		80
Roadway Liability in Georgia		
Atlanta	10/28	109
Roadway Maintenance		
Chamblee	1/19-1/20	44
Thomaston	1/21-1/22	37
Gainesville	1/26-1/27	43
Cartersville	1/28-1/29	46
Jesup	2/3-2/4	47
Tifton	2/10-2/11	32
Tennille	2/17-2/18	<u>36</u>
Total		285
Total number of sessions	22	
Total number of participants	648	

During 1987, the Technology Transfer Center instated the policy of charging a registration fee for participation in a workshop. The purpose of this fee is to assess the interest of the local agencies in the Center and to allow them to express their support through a token financial investment. The registration fee for "Roadway Applications of Geotextiles" and "Traffic Engineering Applications of Microcomputers" was \$30 per person. The total dollars received for these workshops was \$1350 and \$1380, respectively. Since "Roadway Maintenance" was a two-day workshop, the registration fee was \$50 per person, and \$8000 was received. The total amount received from

workshop registration fees is \$10,730.

The Center sought a conclusion as to whether the new policy concerning registration fees had significantly affected workshop participation. Given the data available, it is not possible to make such a conclusion. For example, the attendance for the Roadway Maintenance Workshop in May-June, 1986 was 332. It is difficult to assess whether the 14% drop in attendance resulted from the policy change or because many officials concerned with Roadway Maintenance had attended the previous workshop. Summaries of both the 1986 workshop and the 1988 workshop are included in the appendix for further comparison.

"Roadway Liability in Georgia" was co-sponsored with the Georgia Division of the Institute of Transportation Engineers. The registration fee for that workshop was \$10, but the monies were received by I.T.E..

Newsletters (Tech Trans)

The newsletter is a very valuable tool for the Technology Transfer Center. It provides the opportunity to make local agencies aware of the services which are available through the Center, as well as other programs throughout the Southeast. In addition, the newsletter is a channel for the actual transfer of technology to the local agencies, with pertinent information on new methods and trends.

Tech Trans was published each quarter of 1987, and approximately 2050 copies of the newsletter were distributed each quarter. Total distribution was increased 29% over 1986.

Contents of each newsletter may include the following:

- o Editor's Note: This column is devoted to informing the readers about what is happening at the Center. Policy and personnel changes are noted here, as well as highlighting upcoming events.
- o Articles: Each newsletter contains two or more articles. Articles come from various sources and are chosen for their applicability to the needs of the local agencies in the State.
- o Maintenance Tips: Maintenance tips are selected from the "Field Maintenance Manual for Georgia Counties Local Roads and Streets."
- o Briefs, Trends, and Facts: On the lighter side, several short, news-worthy topics are

published. Some of the items included under this heading are: historical facts, miscellaneous trends, general transportation related news, financial data, and humorous items.

o Publications: Research reports and relevant articles are listed in the newsletter. These may be publications which are available from the Center at no charge or which may be ordered from other agencies. Video tapes are also included.

o Workshops and Conferences: A selective list of upcoming meetings, workshops, etc., concerning relevant topics, are listed so that the local agencies will be aware of such opportunities.

Technical Assistance

The Center has during the past year responded to fifty-four requests for technical assistance.

Requests for assistance are made during workshops, by telephone, or by mail.

Typical areas of technical assistance provided were in microcomputer applications in transportation, roadway surface treatment, signalized intersection analysis, and traffic control and operations. Responses to these requests are provided by telephone, by mail, or by on-site visits.

To illustrate the types of technical assistance provided during the year, consider two examples. The Center Director, accompanied by GDOT Bureau of Transportation personnel, met with staff members of the Macon-Bibb County Transit Authority. Based on a detailed review of their operation, the Director prepared a set of microcomputer specifications. As a result of this effort, a microcomputer system will be installed at the Macon-Bibb County Transit Authority during 1988.

Upon request by the City of Waycross Traffic Engineer, the Center researched the availability of accident record systems applicable for use in Waycross. It was found that the City of Athens was using an appropriate non-proprietary software. The City of Waycross Traffic Engineer and the Center Director went to Athens for a demonstration of the software. A copy of the software and the documentation were obtained from the City of Athens. When the Waycross staff had difficulty installing the software, the Center Director travelled to Waycross and resolved the problem; the City of Waycross is currently using the accident record software.

EVALUATION

In December of 1987, the Technology Transfer Center hired Mr. Grover Bowman to conduct a series of interviews with officials throughout the state in order to evaluate the services offered by the Center and the local agencies' awareness of these services. The bulk of this portion of the Final Report will be based on Mr. Bowman's findings.

As of the compilation of this report, Mr. Bowman has conducted thirty-four interviews in twenty-eight counties in Georgia. Eleven interviews have been with County Commissioners or County Administrators; fourteen have been with County Engineers or Road Superintendents; six interviews have been with City Managers, City Engineers, or Public Works Directors; two have been with Traffic Engineers; and one interview was with a County Clerk. The results of each interview were recorded on the Technology Transfer Data Sheet, which is included in the appendix.

The agencies interviewed have responsibility for approximately 10,000 miles of paved roads and 5500 miles of unpaved roads with an employment force of approximately 1200 in transportation related activities. All of the local officials interviewed consider themselves at least minimally equipped to perform responsibilities as assigned, however, there is considerable variation in the level of sophistication applied in fulfillment of such assigned responsibilities.

All personnel interviewed were aware of the Technology Transfer program and knew that Georgia Tech, the Georgia DOT, and the Federal Government were involved in the program. However, a large number of the officials interviewed primarily related the program to the publication of the newsletter and to the workshops which many had attended. The availability of technical assistance and technical materials as a service of the Center were not as commonly known.

The following comments were compiled according to the four major responsibilities of the Technology Transfer Center--the newsletter, technical assistance, technical materials, and workshops.

Newsletters

A large majority of the officials interviewed currently receive the newsletter. They expressed appreciation for the beneficial information provided and indicated that no changes were necessary, as they generally considered the publication to be excellent.

No meaningful suggestions concerning the newsletter were forthcoming from those responding, but Mr. Bowman has offered a suggestion as a result of his interviews with the local officials. It is suggested that the newsletter include more articles on local procedures, practices, or processes. Such articles would probably be of more interest and relevance to local officials than similar articles about activities in other states.

Technical Assistance

A large number of the officials interviewed were not aware that the Center offered technical assistance upon request, but expressed considerable interest in such a service when informed of its availability. Several County Commissioners suggested that the Center advertise this service through the Area Planning and Development Commissions, possibly making an annual presentation at APDC meetings. It was noted that most of the engineers were aware that the Center offered technical assistance and have utilized this service. Those who had taken advantage of this aspect of the Technology Transfer program commended the excellent quality of service.

Technical Materials

Responses concerning technical materials were very similar to those concerning technical assistance, i.e., non-engineering officials were generally unaware of the availability of technical materials.

At the conclusion of the series of interviews with local officials, Mr. Bowman observed that the Center could increase its effectiveness in this area by serving as a repository for the standard plans of the State, as well as current tests and evaluations of products and materials, and could furnish them to cities and counties upon request.

Workshops

Workshops were the most recognized component of the Technology Transfer program. Without exception, those interviewed considered the workshops an excellent service. No adverse comments were offered, but it was suggested that the local agencies would like to see the development of the on-site presentation concept. The smaller rural counties, in particular, have difficulty allowing their single work supervisor to attend a one or two day workshop. The decreased productivity effected by his absence is a disincentive for the Commissioners to encourage participation. In contrast, these same Commissioners indicated a strong willingness to make available their entire road crew for a three hour subject specific course that would be immediately applicable.

Numerous suggestions were made as to workshop subjects that would be of value to those agencies interviewed. A summary listing of those subjects follows.

Asphalt Plant Inspection	Soil Erosion
Bridge Maintenance	Simplified County Bridge Construction
Bridge Pier Replacement	Soil Compaction Testing
Computer Training	Soil Erosion & Sediment Control
Drainage	Soil Stabilization
Equipment Operators' Training	State/local Interaction
Flagman Certification	Storm Water Management
Guardrail Installation	Street Lighting
Herbicides	Subdivision Regulations
MUTCD	Supervisory Training
Preventive Maintenance	Surveying
Public Relations	Tort Liability
Patching	Traffic Analysis
Right-of-way Acquisition	Traffic Control
Roadway Inventory Procedures	Utilities
Roadway Maintenance	Wood Bridges
Safety	Zoning Ordinances & Enforcement

Additional suggestions were made that the Center serve as a focal point to bring together selected small urban representation to serve as a "brainstorming" group in establishing standards for a good Public Works program.

Interview results indicated that few engineering consulting firms are utilized in Georgia for roadway activities. Those agencies which receive the additional 1% sales tax sometimes engage a consultant to coordinate that program. Also, local agencies occasionally encounter a unique

situation that warrants specialized expertise. For the most part, however, the local agencies rely on assistance from the State DOT.

The policy of charging for workshop participation, which was recently instated, has created limited problems. Several agencies indicated that the charge would not preclude their participation, but would reduce the number of representatives that could attend. It was noted that the University of Georgia charges \$10 - \$15 per day for their workshops.

Ranking of the four program components in terms of their importance to local agencies was 1)workshops, 2)newsletters, 3)technical assistance, and 4)technical materials, with the last two being almost equal in relative importance to local agencies. In rural counties in particular, it is recognized that the Technology Transfer Program provides the only training opportunities which are realistically available to them. Accordingly, they commend past performance and encourage continued efforts to bring practical technical knowledge and assistance to them.

CONCLUSION

As a result of the statistics included in this report regarding the activities of the Technology Transfer Center and the findings of Mr. Bowman, one must conclude that the Center is continuing to gain momentum and credibility in its service to the local agencies. The Center is recognized for and commended for its good work in making practical transportation information available to agencies that are otherwise limited in their resources for such assistance. The workshops and the newsletters have been lauded as an asset to agencies in Georgia.

Mr. Bowman's findings indicate that the technical assistance and materials that the Center offers could be better utilized if the local agencies were better informed of these opportunities. The Center will endeavor to market these services more effectively.

The evaluation concerning workshops contains an extensive list of topics, which were suggested by the local officials interviewed by Mr. Bowman. It is evident that the needs of the local agencies are many and varied. Through initiating the program of on-site workshops which was suggested in the evaluation section of this report, the Center would be better able to address the specific needs of individuals agencies through workshop presentations. This benefit, in addition to the increased participation discussed earlier, is a great incentive for the Center to pursue a slight modification in emphasis.

In conclusion, the Georgia Tech Technology Transfer Center continues to grow as an effective and viable means of technology transfer for communities in Georgia. Through continual re-evaluation, the Center can continue to meet the spoken and unspoken needs of agencies in the state with applicable and effective information.

APPENDIX

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LAGRANGE, GA 30241

HON. WADE MILUM
DISTRICT 81
P.O. DRAWER 1649
LAGRANGE, GA 30241

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TROUP COUNTY
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HON. V. HAWLEY SMITH
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HARTWELL, GA 30243

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1471 HWY 124 NORTH
LAWRENCEVILLE, GA 30245

CITY ENGINEER
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LAWRENCEVILLE, GA 30245

HON. LILLIAN WEBB CHM.
COUNTY COMM.
240 OAK STREET
COUNTY ADM. BLDG.
LAWRENCEVILLE, GA 30245

COUNTY ENGINEER
COUNTY COURTHOUSE
LAWRENCEVILLE, GA 30245

HON. STEVE PATE
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P.O. BOX 1017
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LAWRENCEVILLE, GA 30245

MARLENE BARTON
RIDESHARE COORD.
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240 OAK STREET
LAWRENCEVILLE, GA 30245

HON. DON PEEVY
DISTRICT 48
P.O. BOX 862
LAWRENCEVILLE, GA 30246

HON. REX MILLSAPS
DISTRICT 61
P.O. BOX 761
LAWRENCEVILLE, GA 30246

HON. J. R. MORTON JR.
MAYOR
76 MAIN ST.
CITY HALL
LILBURN, GA 30247

HON. MIKE BARNETT
DISTRICT 59
1472 RIDGEWOOD DR.
LILBURN, GA 30247

HON. THOMAS WHITE
DISTRICT 62
404 JAMES ST.
LILBURN, GA 30247

MAYOR JERRY ELKINS
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CITY ENGINEER
P.O. BOX 97
LOCUST GROVE, GA 30248

CITY ENGINEER
P.O. BOX 128
LOGANSVILLE, GA 30249

HON. MICHAEL JONES
MAYOR
P.O. BOX 128
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LOGANVILLE, GA 30249

MAYOR W. B. PEEK
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HON. HAROLD BEVIS JR.
MAYOR
5347 JONESBORO ROAD
CITY HALL
LAKE CITY, GA 30252

PAUL BENEFIELD
POLICE CHIEF
5347 JONESBORO RD.
LAKE CITY, GA 30252

HON. PAUL SMITH CHM.
HENRY CO. COMM.
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McDONOUGH, GA 30253

HON. BILLY COPELAND
MAYOR
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CITY HALL
McDONOUGH, GA 30253

HON. WESLEY DUNN
DISTRICT 73
P.O. BOX 1014
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HON. ALEX CRUMBLY
DISTRICT 17
430 BURKE CIRCLE
MCDONOUGH, GA 30253

MR. JAMES WARREN
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HENRY COUNTY D.O.T.
121 WORKCAMP ROAD
MCDONOUGH, GA 30253

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SPRINGS ROAD
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CITY HALL
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HON. RUDOLPH JOHNSON
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MORROW, GA 30260

SUPT. OF PUBLIC WORKS
COUNTY COURTHOUSE
NEWNAN, GA 30263

HON. NEAL SHEPARD
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21 5TH ST.
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230 E. NEWNAN ROAD
NEWNAN, GA 30263

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SUPPORT SVCS. SUPT.
P'TREE CITY PUBLIC WORKS
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POLICE CHIEF
6690 CHURCH ST.
RIVERDALE, GA 30274

RICHARD SMITH
SUP'T OF ST. MAINT.
CITY OF RIVERDALE
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GWINNETT COUNTY
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102 CAMP CREEK CT.
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209 MCINTOSH TRAIL
PEACHTREE CITY, GA 30269

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SHARPSBURG, GA 30277

HON. EMMETT CLOWER
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SNELLVILLE, GA 30278

HON. R. G. KELLEY
MAYOR
CITY OF STOCKBRIDGE
130 BERRY STREET
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PEACHTREE CITY, GA 30269

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MAYOR
6690 CHURCH ST.
CITY HALL
RIVERDALE, GA 30274

BOYD COMMINGS
SUP'T OF WATER & SEWER
CITY OF RIVERDALE
6690 CHURCH STREET
RIVERDALE, GA 30274

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CO. ROAD SUPERINTENDENT
COURTHOUSE
THOMASTON, GA 30286

HON. IRVIN HENDRICKS CHM.
UPSON CO. COMM.
COUNTY COURTHOUSE
THOMASTON, GA 30286

HON. MARTIN ADAMS
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709 GREENWOOD RD.
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PIKE COUNTY
WILLIAMSON, GA 30292

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PIKE COUNTY CHAIRMAN
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ZEBULON, GA 30295

MAYOR HOWARD M. RAWLINS
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ZEBULON, GA 30295

CITY ENGINEER
P.O. BOX 385
ZEBULON, GA 30295

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68 MITCHELL STREET
ATLANTA, GA 30303

LEROY STYNCHCOMBE
SHERIFF
136 PRYOR ST. S.W.
ATLANTA, GA 30303

COUNTY ENGINEER
165 CENTRAL AVE. S.W.
ATLANTA, GA 30303

CLINTON CHAFIN
POLICE CHIEF
183 CENTRAL AVE. S.W.
ATLANTA, GA 30303

WYVERN BUDRAM
FULTON COUNTY
42 SPRING ST. PL.31
ATLANTA, GA 30303

HON. MICHAEL LOMAX CHM.
FULTON CO. COMM.
65 CENTRAL AVENUE SW
409 COURTHOUSE ANNEX
ATLANTA, GA 30303

MORRIS REDDING
POLICE CHIEF
175 DECATUR ST. S.E.
ATLANTA, GA 30303

MARWAN ABBODD
42 SPRING ST.
PLAZA LEVEL 31
RICH'S BLDG.
ATLANTA, GA 30303

MR. JAMES BURGESS
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GEORGIA MUNICIPAL ASSOC.
34 PEACHTREE STREET
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ATLANTA, GA 30303

MR. HILL HEALAN
DIRECTOR
ASSOC. COUNTY COMM.
134 PEACHTREE STREET
SUITE 1201
ATLANTA, GA 30303

KARLA KARRE'
CITY OF ATLANTA
236 FORSYTH STREET
ATLANTA, GA 30303

GEORGE SCOTT
CITY OF ATLANTA
236 FORSYTH STREET
ATLANTA, GA 30303

D.H. GAINES
CITY OF ATLANTA
236 FORSYTH STREET
ATLANTA, GA 30303

HON. JOHN GREER
DISTRICT 39
925 HEALY BLDG.
ATLANTA, GA 30303

MAYOR ANDREW YOUNG
CITY HALL
ATLANTA, GA 30303

HONORABLE SAM NUNN
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75 SPRING STREET SW
ATLANTA, GA 30303

HON. WYCHE FOWLER
US REP 5TH DIST
10 PARK PLACE
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ATLANTA, GA 30303

WINSTON PARKER
FULTON. CO. LAND DEPT.
WILLIAM OLIVER BLDG.
SUITE 403
32 PEACHTREE ST.
ATLANTA, GA 30303

HON. PAUL COVERDELL
DISTRICT 40
2015 PTREE RD. NE
ATLANTA, GA 30309

MARY KAY JACKSON
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WIDEMAN & SINGLETON INC.
1789 PEACHTREE RD. NE
ATLANTA, GA 30309

HON. JULIAN BOND
DISTRICT 39
361 WESTVIEW DR. SW
ATLANTA, GA 30310

HON. TYRONE BROOKS
DISTRICT 34
STA. A P.O. BOX 11185
ATLANTA, GA 30310

HON. DOUGLAS DEAN
DISTRICT 29
356 ARTHUR ST SW
ATLANTA, GA 30310

HON. HORACE TATE
DISTRICT 38
621 LILLA DR. SW
ATLANTA, GA 30310

SPENCE JUNIE JR.
TECHNICIAN I
954 LAURELMONT DR.
ATLANTA, GA 30311

HON. LORENZO BENN
DISTRICT 38
579 FIELDING LA. SW
ATLANTA, GA 30311

HON. J. C. DOUGHERTY
DIST 33
15 CHESTNUT ST
ATLANTA, GA 30314

CYNTHIA TEASLEY
CREW SUPERVISOR
ATLANTA P.W.
1150 NORTH AVENUE
ATLANTA, GA 30314

HAROLD MCELROY
STOREKEEPER III
ATLANTA P.W.
1150 NORTH AVENUE
ATLANTA, GA 30314

MARSHALL MAHAFFEY
PLANT SUPERINTENDENT
ATLANTA P.W.
1150 NORTH AVENUE
ATLANTA, GA 30314

HON. GRACE HAMILTON
DISTRICT 31
582 UNIVERSITY PI NW
ATLANTA, GA 30314

DR. EDWARD DAVIS
MGT-BUS. ADMINISTRATION
223 CHESTNUT STREET
ATLANTA UNIVERSITY
ATLANTA, GA 30314

MARVIN BARBER
ASS'T SUP'T
CITY OF ATLANTA
120 CLAIRE DR. SW
ATLANTA, GA 30315

ED MORGAN
ATLANTA TRAFFIC & TRANS.
120 CLAIRE DR. SW
ATLANTA, GA 30315

ROGER DENTON
ATLANTA TRAFFIC & TRANS.
120 CLAIRE DR. SW
ATLANTA, GA 30315

HON. DAVID SCOTT
DISTRICT 36
190 WENDELL DR. SE
ATLANTA, GA 30315

HON. GEORGINNA SINKFIELD
DISTRICT 37
179 TONAWANDA DR.
ATLANTA, GA 30315

HON. PAUL BOLSTER
DISTRICT 30
1043 ORMEWOOD AVE. SE
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HON. BETTY CLARK
DISTRICT 55
P.O. BOX 17852
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HON. HOSEA WILLIAMS
DISTRICT 54
8 E LAKE DR NE
ATLANTA, GA 30317

CHARLIE REEVES JR.
CREW MAINT. SUPERVISOR
CITY OF ATLANTA
1587 HORTENSE PT. NW
ATLANTA, GA 30318

HON. J. B. MCKINNEY
DISTRICT 35
765 SHORTER TER NW
ATLANTA, GA 30318

HARRY RICE
PBS & J
1575 NORTHSIDE DRIVE
SUITE 350
ATLANTA, GA 30318

HON. MAX DAVIS
DISTRICT 45
1177 W NANCY CR. DR NE
ATLANTA, GA 30319

HON. JAMES TYSINGER
DISTRICT 41
3781 WATKINS PL NE
ATLANTA, GA 30319

HON. BARBARA COUCH
DISTRICT 40
2864 W ROXBORO RD NE
ATLANTA, GA 30324

HON. CATHEY STEINBERG
DISTRICT 46
1732 DUNWOODY PI
ATLANTA, GA 30324

HON. SIDNEY MARCUS
DISTRICT 26
845 CANTERBURY RD NE
ATLANTA, GA 30324

NORMAN H. PERRY
MARTA
2424 PIEDMONT RD. NE
ATLANTA, GA 30324-3324

CONNIE CANNON
MARTA
2424 PIEDMONT RD. NE
ATLANTA, GA 30324-3324

EDWARD KOROSHETZ
MARTA
2424 PIEDMONT RD. NE
ATLANTA, GA 30324-3324

KEN FERN
COUNCIL OF STATE GOV.
3384 PEACHTREE RD. NE
SUITE 830
ATLANTA, GA 30326

HON. DOROTHY FELTON
DISTRICT 22
465 TANACREST DR NW
SANDY SPRINGS, GA 30328

RICHARD COMBES
DIVISION CHIEF
INDUSTRIAL EXT. DIVISION
EDL-BES
GEORGIA TECH
ATLANTA, GA 30332

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DIRECTOR
SCHOOL OF CIVIL ENG.
GEORGIA TECH
ATLANTA, GA 30332

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VICE PRES. RES.
VP RES.- ADMINISTRATION
GEORGIA TECH
ATLANTA, GA 30332

DR. WILLIAM SANGSTER
DEAN COL. OF ENG.
DEAN OF ENG - ADMIN.
GEORGIA TECH
ATLANTA, GA 30332

DR. HENRY BOURNE
VICE PRES. ACAD. AFF
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GEORGIA TECH
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DR. ALBERT SHEPPARD
ASSO. VICE PRES. RES.
VP RES.- ADMINISTRATION
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DR. W. FREESTON
ASSO. DEAN OF ENG. COL.
DEAN COL. OF ENG.- ADMIN.
GEORGIA TECH
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INST. REL. AND DEV.
VP INST. REL & DEV.
GEORGIA TECH
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MERCY EDWARDS
CONTINUING EDUCATION
308 SWANN BLDG.
DEPT. OF CONT. EDUC.
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DR. PAUL WRIGHT
PROFESSOR
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GEORGIA TECH
ATLANTA, GA 30332

DR. PETE PARSONSON
PROFESSOR
SCHOOL OF CIVIL ENG.
GEORGIA TECH
ATLANTA, GA 30332

HON. WAYMOND HUGGINS
SEN. DIST. 53
122 STATE CAPITOL
ATLANTA, GA 30334

T. D. GUPTON
GDOT
NO. 2 CAPITOL SQUARE
ATLANTA, GA 30334

BURT RIDDLE
GDOT
NO. 2 CAPITOL SQUARE
ATLANTA, GA 30334

MR. HALL RIVES
DEPT. OF TRANSPORTATION
NO. 2 CAPITOL SQUARE
ATLANTA, GA 30334

PHIL BRYANT
TRAINING PROGRAM DIR.
ROOM 268 GDOT
NO. 2 CAPITOL SQUARE
ATLANTA, GA 30334

RICK SMITH
DEPT. OF TRANSPORTATION
ROOM 307
NO. 2 CAPITOL SQUARE
ATLANTA, GA 30334

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BUREAU OF HWYS AND ST.
CITY OF ATLANTA
DEPT. OF PUBLIC WORKS
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ARC
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FULTON COUNTY
165 CENTRAL AVE
ROOM 300
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P. W. PERSONNEL
CITY HALL
P.O. BOX F
COLLEGE PARK, GA 30337

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GA DEPT OF TRANSPORTATION
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GA ASPHALT PAVEMENT ASSOC
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380 INTERSTATE NORTH
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KECK & WOOD INC.
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GDOT DISTRICT 7
5025 NEW PEACHTREE RD.
CHAMBLEE, GA 30341

THURMAN TERRELL
POLICE CHIEF
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CHAMBLEE, GA 30341

HOWELL LANCASTER
GDOT
5025 NEW PEACHTREE ROAD
CHAMBLEE, GA 30341

JOHN REID
GDOT
5025 NEW PEACHTREE RD.
CHAMBLEE, GA 30341

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5025 NEW PEACHTREE ROAD
CHAMBLEE, GA 30341

JASON MCCOOK
GDOT
5025 NEW PEACHTREE ROAD
CHAMBLEE, GA 30341

ANTHONY JONES
GDOT
5025 NEW PEACHTREE ROAD
CHAMBLEE, GA 30341

WALTER M. EDWARDS
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5025 NEW PEACHTREE ROAD
CHAMBLEE, GA 30341

VAN SEDWICK
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CHAMBLEE, GA 30341

BRENDA GOWEN
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5025 NEW PEACHTREE ROAD
CHAMBLEE, GA 30341

JAMES E. PHILLIPS
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CITY ENGINEER
2777 EAST POINT STREET
EAST POINT, GA 30344

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2704 HUMPHRIES DR.
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HON. JOE BURTON
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DISTRICT 36
3417 NORTHSIDE DR.
HAPEVILLE, GA 30354

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1720 PEACHTREE RD. NW
SUITE 300
ATLANTA, GA 30367

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FHWA
1720 PEACHTREE RD. NW
SUITE 200
ATLANTA, GA 30367

JOSE GARCIA
FHWA
1720 PEACHTREE RD. NW
SUITE 300
ATLANTA, GA 30367

MR. GLEN E. PRICE
FHWA
SUITE 200
1720 PEACHTREE RD. N.W.
ATLANTA, GA 30367

MR. HARVEY PHLEGAR
FEDERAL HWY. ADMIN
SUITE 200
1720 PEACHTREE ROAD N.W.
ATLANTA, GA 30367

CO. ROAD SUPERINTENDENT
COURTHOUSE
SWAINSBORO, GA 30401

STREET SUPERINTENDENT
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SWAINSBORO, GA 30401

HON. SAM SMITH CHM.
EMANUEL CO. COMM.
COUNTY COURTHOUSE
SWAINSBORO, GA 30401

HON. JAMES BUCKLEY
MAYOR
101 MAIN ST.
CITY HALL
SWAINSBORO, GA 30401

HON. BILL ENGLISH
DISTRICT 21
214 GOLD DR.
SWAINSBORO, GA 30401

HON. NATHAN DEAN
DISTRICT 31
340 WINGFOOD ST.
ROCKMART, GA 30401

HON. RANDOLPH CARRH
DISTRICT 109
P.O. DRAWER K
SWAINSBORO, GA 30401

SAM F. SMITH
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EMANUEL COUNTY COURTHOUSE
SWAINSBORO, GA 30401

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DISTRICT 110
401 LANE ST.
BROOKLET, GA 30415

COUNTY ENGINEER
COURTHOUSE
CLAXTON, GA 30417

HON. WILLIAM DELOACH CHM.
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COUNTY COURTHOUSE
CLAXTON, GA 30417

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MAYOR
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CITY HALL
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DAYNE DELOACH
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CO. ROAD SUPERINTENDENT
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LOUISVILLE, GA 30434

CITY ENGINEER
CITY HALL
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HON. EMORY BARGERON
DISTRICT 108
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417 N. STATE ST.
LYONS, GA 30436

HON. MELL TAYLOR CHM.
TOOMBS CO. COMM.
COUNTY COURTHOUSE
ROUTE 1
LYONS, GA 30436

HON. W.T. AIKEN
MAYOR
417 NORTH STATE ST.
CITY HALL
LYONS, GA 30436

HON. GEORGE BIRD CHM.
CANDLER CO. COMM.
COUNTY COURTHOUSE
METTER, GA 30439

EDDIE GRANT
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CANDLER COUNTY
302 HERSCHEL DRIVE
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CO. ROAD SUPERINTENDENT
COURTHOUSE
MILLEN, GA 30442

HON. CHARLES BRAGG CHM.
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MILLEN, GA 30442

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COURTHOUSE
Mt. VERNON, GA 30445

HON. JULIAN WARNOCK CHM.
MONTGOMERY CO. COMM.
COUNTY COURTHOUSE
MT VERNON, GA 30445

HON. J.M. FOUNTAIN
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HON. DENVER LANIER CHM.
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CO. ROAD SUPERINTENDENT
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REIDSVILLE, GA 30453

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HON. JIM GILLIS CHM.
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SOPERTON, GA 30457

HON. FRANK RADFORD
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SOPERTON, GA 30457

HON. HUGH GILLIS SR.
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HON. L. L. PHILLIPS
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CITY ENGINEER
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CITY ENGINEER
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STATESBORO, GA 30458

CO. ROAD SUPERINTENDENT
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HON. THURMAN LANIER
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SYLVANIA, GA 30467

STREET SUPERINTENDENT
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DIST. SUPERVISOR
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HALL COUNTY
CALVARY CHURCH RD.
GAINESVILLE, GA 30501

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HALL COUNTY
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GAINESVILLE, GA 30501

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DIST. SUPERVISOR
HALL CO. COURTHOUSE
GAINESVILLE, GA 30501

HON. JERRY NIX CHM.
HALL CO. COMM.
COUNTY COURTHOUSE
GAINESVILLE, GA 30501

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CHESTNUT MTN, GA 30502

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DISTRICT 49
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GAINESVILLE, GA 30503

HON. JOE WOOD
DISTRICT 9 POST 1
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GAINESVILLE, GA 30503

HON. BOBBY LAWSON
DISTRICT 9 POST 2
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BLUE RIDGE, GA 30512

CO. ROAD SUPERINTENDENT
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BLAIRSVILLE, GA 30512

HON. GLEN GOOCH
UNION CO. COMM.
COUNTY COURTHOUSE
BLAIRSVILLE, GA 30512

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DISTRICT 4 POST 1
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BLAIRSVILLE, GA 30512

CO. ROAD SUPERINTENDENT
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BLUE RIDGE, GA 30513

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30 GARNETT STREET
BUFORD, GA 30518

HON. THOMAS HUGHES
MAYOR
30 GARNETT STREET
CITY HALL
BUFORD, GA 30518

HON. CHARLES MARTIN
DISTRICT 60
470 HILL ST.
BUFORD, GA 30518

CO. ROAD SUPERINTENDENT
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CARNESTVILLE, GA 30521

HON. RON MILLER CHM.
FRANKLIN CO. COMM.
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CARNESTVILLE, GA 30521

HON. OLIVE FORDE CHM.
HABERSHAM CO. COMM.
COUNTY COURTHOUSE
CLARKESVILLE, GA 30523

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COMMISSIONER
HABERSHAM CO.
CO. COURTHOUSE
CLARKESVILLE, GA 30523

CO. ROAD SUPERINTENDENT
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CLARKESVILLE, GA 30523

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DISTRICT 11 POST 1
TIMBROOK ROUTE 2
HOLLYWOOD, GA 30523

CO. ROAD SUPERINTENDENT
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CLAYTON, GA 30525

HON. MAX WATTS CHM.
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COUNTY COURTHOUSE
CLAYTON, GA 30525

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HON. THOMAS DOSTER
MAYOR
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CITY ENGINEER
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CO. ROAD SUPERINTENDENT
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CLEVELAND, GA 30528

HON. LANIER CHAMBERS CHM.
WHITE CO. COMM.
COUNTY COURTHOUSE
CLEVELAND, GA 30528

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WINDER POLICE DEPT.
P.O. BOX 293
COMMERCE, GA 30529

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COMMERCE, GA 30529

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DISTRICT 12
RT. 5 DOGWOOD TR
COMMERCE, GA 30529

HON. DON HIGGENS
MAYOR
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CORNELIA, GA 30531

HON. JOHN FOSTER
DISTRICT 50
P.O. BOX 100
CORNELIA, GA 30531

CO. ROAD SUPERINTENDENT
COURTHOUSE
DAHLONEGA, GA 30533

STREET SUPERINTENDENT
P.O. BOX 565
DAHLONEGA, GA 30533

HON. J. B. JONES
LUMPKIN CO. COMM.
COUNTY COURTHOUSE
DAHLONEGA, GA 30533

HON. HAINES HILL
MAYOR
201 WEST MAIN ST.
CITY HALL
DAHLONEGA, GA 30533

CITY ENGINEER
P.O. BOX 6
DAWSONVILLE, GA 30534

CO. ROAD SUPERINTENDENT
COURTHOUSE
DAWSONVILLE, GA 30534

HON. JOE LANE COX CHM.
DAWSON CO. COMM.
COUNTY COURTHOUSE
DAWSONVILLE, GA 30534

CITY ENGINEER
P.O. BOX 128
DEMOREST, GA 30535

CO. ROAD SUPERINTENDENT
COURTHOUSE
ELLIJAY, GA 30540

HON. BEN WHITAKER CHM.
GILMER CO. COMM.
COUNTY COURTHOUSE
ELLIJAY, GA 30540

HON. HENRY GARTRELL
MAYOR
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CITY HALL
ELLIJAY, GA 30540

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CITY OF HELEN
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CITY MANAGER
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CO. ROAD SUPERINTENDENT
COURTHOUSE
HIAWASSEE, GA 30546

HON. TRUMAN BARRETT
PROBATE JUDGE/COMM.
TOWNS CO. COMM.
COUNTY COURTHOUSE
HIAWASSEE, GA 30546

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COUNTY COURTHOUSE
HOMER, GA 30547

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JEFFERSON, GA 30549

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COUNTY COURTHOUSE
JEFFERSON, GA 30549

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LAVONIA, GA 30553

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TOCCOA, GA 30577

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COUNTY COURTHOUSE
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ASST STREET SUPT
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TALIAFERRO CO. COMM.
COUNTY COURTHOUSE
CRAWFORDVILLE, GA 30631

CO. ROAD SUPERINTENDENT
COURTHOUSE
CRAWFORDVILLE, GA 30632

CO. ROAD SUPERINTENDENT
COURTHOUSE
DANIELSVILLE, GA 30633

HON. BILL MADDEN CHM.
MADISON CO. COMM.
COUNTY COURTHOUSE
DANIELSVILLE, GA 30633

HON. LOUIS CLARK
DISTRICT 13 POST 1
ROUTE 2
DANIELSVILLE, GA 30633

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ELBERTON, GA 30635

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COUNTY COURTHOUSE
ELBERTON, GA 30635

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ELBERTON, GA 30635

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COUNTY COURTHOUSE
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HON. PARKS BROWN
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HON. BILLY MILFORD
DISTRICT 13 POST 2
ROUTE 3
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CO. ROAD SUPERINTENDENT
COURTHOUSE
LEXINGTON, GA 30648

HON. J. W. GRIFFITH CHM.
OGLETHORPE CO. COMM.
COUNTY COURTHOUSE
LEXINGTON, GA 30648

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STAN HUTCHINGS
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COUNTY COURTHOUSE
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HON. JOHN BEARD
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CO. ROAD SUPERINTENDENT
COURTHOUSE
WASHINGTON, GA 30673

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ROOM 201
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WASHINGTON, GA 30673

HON. SAM MCGILL
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OCONEE CO. COMM.
COUNTY COURTHOUSE
WATKINSVILLE, GA 30677

BUBBER WILKES
COUNTY COMMISSIONER
COURTHOUSE
WATKINSVILLE, GA 30677

CITY ENGINEER
P.O. BOX 566
WINDER, GA 30680

KEITH WITCHER
WINDER POLICE DEPT.
320 S. BROAD ST.
WINDER, GA 30680

CO. ROAD SUPERINTENDENT
COURTHOUSE
WINDER, GA 30680

CLIFFORD SYKES
WINDER POLICE DEPT.
320 S. BROAD ST.
WINDER, GA 30680

HON. JIM HARWELL CHM.
BARROW CO. COMM.
310 SOUTH BROAD STREET
WINDER, GA 30680

HON. JOHN MOBLEY JR.
MAYOR
P.O. BOX 566
CITY HALL
WINDER, GA 30680

HON. JOHN RUSSELL
DISTRICT 64
P.O. BOX 588
WINDER, GA 30680

EDWIN FLEEMAN
CHIEF OF POLICE
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WINTERVILLE, GA 30683

HELEN WILLIAMS
CITY CLERK
P.O. BOX 306
WINTERVILLE, GA 30683

CITY ENGINEER
P.O. BOX 248
CALHOUN, GA 30701

COUNTY ENGINEER
COURTHOUSE
CALHOUN, GA 30701

HON. HAROLD FAITH CHM.
GORDON CO. COMM.
P.O. BOX 580
CALHOUN, GA 30701

HON. MAX BRANNON
DISTRICT 51
P.O. BOX 1027
CALHOUN, GA 30701

MELVIN GREESON
MEMBER
GORDON CO. BOARD OF COMM
100 COURT STREET
CALHOUN, GA 30701

HON. J. C. MADDOX
DISTRICT 7
ROUTE 1
CALHOUN, GA 30701

CO. ROAD SUPERINTENDENT
COURTHOUSE
CHATSWORTH, GA 30705

STREET SUPERINTENDENT
P.O. BOX 516
CHATSWORTH, GA 30705

HON. KIRBY PATTERSON CHM.
MURRAY CO. COMM.
P.O. BOX 1129
CHATSWORTH, GA 30705

HON. W. FINCHER JR.
DISTRICT 54
P.O. DRAWER 400
CHATSWORTH, GA 30705

HON. TOM RAMSEY
DISTRICT 3
P.O. BOX 1130
CHATSWORTH, GA 30705

HON. FRANK PIERCE
MAYOR
P.O. BOX 68
CITY HALL
CHICKAMAUGA, GA 30707

HON. DONALD OLIVER
DISTRICT 1 POST 1
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CHICKAMAUGA, GA 30707

CITY ENGINEER
P.O. BOX 1205
DALTON, GA 30720

COUNTY ENGINEER
COURTHOUSE
DALTON, GA 30720

HON. LEONARD COCHRAM CHM.
WHITFIELD CO. COMM.
P.O. BOX 248
DALTON, GA 30720

HON. JIMMY YOUNG JR.
MAYOR
P.O. BOX 1205
CITY HALL
DALTON, GA 30720

HON. PHILIP FOSTER
DISTRICT 6 POST 2
411 COLLEGE DR.
DALTON, GA 30720

HON. ROGER WILLIAMS
DISTRICT 6 POST 1
132 HUNTINGTON RD
DALTON, GA 30720

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EXECUTIVE DIRECTOR
NORTH GEORGIA APDC
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DALTON, GA 30720

MR. DONALD H. PIKE
TEXT. RUBBER & CHEM
ULDRAPAVE DIV.
1300 TIARCO DRIVE SW
DALTON, GA 30720

HON. FOREST HAYS JR.
DISTRICT 1 POST 2
ROUTE 2
FLINTSTONE, GA 30725

COUNTY ENGINEER
COURTHOUSE
LAFAYETTE, GA 30728

STREET SUPERINTENDENT
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HARRY WAITS
TRAFFIC ENGINEER
DOT
CITY HALL
LAFAYETTE, GA 30728

CHIEF CHARLES RICHARDSON
POLICE CHIEF
CITY HALL
LAFAYETTE, GA 30728

MR. DAVID ALDRICH
CITY MANAGER
CITY HALL
LAFAYETTE, GA 30728

MR. MARTIN SIMMONS
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HON. ROY PARRISH
WALKER CO. COMM.
BOX 445
LAFAYETTE, GA 30728

HON. LYLE JONES
MAYOR
P.O. BOX 89
CITY HALL
LAFAYETTE, GA 30728

HON. JOHN CRAWFORD
DISTRICT 5
ROUTE 1 BOX 518
LYERLY, GA 30730

HON. JAMES MORELAND CHM.
CATOOSA CO. COMM.
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CO. ROAD SUPERINTENDENT
206 E. NASHVILLE STREET
RINGGOLD, GA 30736

HON. JOE BARGER
MAYOR
105 MOUNTAIN ST.
CITY HALL
RINGGOLD, GA 30736

HON. ROBERT PETERS
DISTRICT 2
P.O. BOX 550
RINGGOLD, GA 30736

KAREN CAUSBY
EXECUTIVE DIRECTOR
CATOOSA COUNTY
ECONOMIC DEV. COMM.
P. O. BOX 52
RINGGOLD, GA 30736

STREET SUPERINTENDENT
P.O. BOX 159
ROSSVILLE, GA 30741

HON. CHARLES SHERBILL
MAYOR
P.O. BOX 159
CITY HALL
ROSSVILLE, GA 30741

CITY ENGINEER
P.O. BOX 180
SUMMERVILLE, GA 30747

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CHATTOOGA COUNTY
CHAMBER OF COMMERCE
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SUMMERVILLE, GA 30747

HON. WAYNE DENSON CHM.
CHATTOOGA CO. COMM.
P.O. BOX 211
SUMMERVILLE, GA 30747

CO. ROAD SUPERINTENDENT
P.O. BOX 211
SUMMERVILLE, GA 30747

HON. SEWELL CASH
MAYOR
P.O. BOX 180
CITY HALL
SUMMERVILLE, GA 30747

HON. LARRY MOORE CHM.
DADE CO. COMM.
P.O. BOX 613
TRENTON, GA 30752

PRESTON DANIELS
FOREMAN
P.O. BOX 763
TRENTON, GA 30752

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
TRENTON, GA 30752

HON. A. T. LAWSON
MAYOR
BOX 518
CITY HALL
TRENTON, GA 30752

CHARLES NORRIS
ROAD SUPT.
COLUMBIA COUNTY
ROUTE 2 BOX 41143
APPLING, GA 30802

CO. ROAD SUPERINTENDENT
COURTHOUSE
GIBSON, GA 30810

HON. CHARLES ROBERTS CHM.
GLASCOCK CO. COMM.
P.O. BOX 66
GIBSON, GA 30810

HON. LEON DAVIDSON
MAYOR
P.O. BOX 120
CITY HALL
GROVETOWN, GA 30813

CO. ROAD SUPERINTENDENT
COURTHOUSE
LINCOLNTON, GA 30817

HON. WALKER NORMAN CHM.
LINCOLN CO. COMM.
P.O. BOX 340
LINCOLNTON, GA 30817

HON. BEN ROSS
DISTRICT 82
P.O. BOX 245
LINCOLNTON, GA 30817

STREET SUPERINTENDENT
P.O. BOX 953
THOMSON, GA 30824

CO. ROAD SUPERINTENDENT
COURTHOUSE
THOMSON, GA 30824

HON. WILLIAM HAWKINS CHM.
McDUFFIE CO. COMM.
P.O. BOX 28
THOMSON, GA 30824

HON. ROBERT KNOX
MAYOR
P.O. BOX 1017
CITY HALL
THOMSON, GA 30824

HON. WARREN EVANS
DISTRICT 84
P.O. BOX 539
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CO. ROAD SUPERINTENDENT
COURTHOUSE
WARRENTON, GA 30828

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HON. ALLEN MAY
WARREN CO. COMM.
P.O. BOX 46
WARRENTON, GA 30828

HON. C. E. PHELPS SR.
MAYOR
P.O. BOX 109
CITY HALL
WARRENTON, GA 30828

HON. RAY DELAIGLE CHM.
BURKE CO. COMM.
P.O. BOX 62
WAYNESBORO, GA 30830

CO. ROAD SUPERINTENDENT
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WAYNESBORO, GA 30830

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CITY HALL
WAYNESBORO, GA 30830

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AUGUSTA AREA OFFICE
GEORGIA TECH
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AUGUSTA, GA 30901

COUNTY ENGINEER
CITY-COUNTY BLDG.
AUGUSTA, GA 30902

HON. DAVID SHERROUSE CHM
RICHMOND CO. ADM.
COUNTY/CITY BLDG. Rm 605
AUGUSTA, GA 30902

HON. JIMMY LESTER
DISTRICT 23
985 BROAD ST.
AUGUSTA, GA 30902

CITY ENGINEER
530 GREEN STREET
AUGUSTA, GA 30903

HON. THOMAS F. ALLGOOD
DISTRICT 22
P.O. BOX 1523
AUGUSTA, GA 30903

HON. GEORGE BROWN
DISTRICT 88
P.O. BOX 1114
AUGUSTA, GA 30903

HON. JACK CONNELL
DISTRICT 87
P.O. BOX 308
AUGUSTA, GA 30903

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AUGUSTA, GA 30904

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EXECUTIVE DIRECTOR
CENT. SAV. RIVER APDC
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LARRY J. COBURN
2316 TOBACCO ROAD
AUGUSTA, GA 30906

HON. MICHAEL PADGETT
DISTRICT 86
ROUTE 1 BOX 5
AUGUSTA, GA 30906

MR. MILLARD F. GOODING
SUPERINTENDENT
ROADS AND BRIDGES DEPT.
RICHMOND CO.
2316 TOBACCO ROAD
AUGUSTA, GA 30906

HON. A. R. LANE CHM.
COLUMBIA CO. COMM.
P.O. BOX 11204
MARTINEZ, GA 30907

COUNTY ENGINEER
P.O. BOX 11024
MARTINEZ, GA 30907

HON. WILLIAM JACKSON
DISTRICT 83
3907 WASHINGTON RD.
MARTINEZ, GA 30907

T. R. SWEENEY
CHIEF OF ENG. SERVICES
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MARTINEZ, GA 30907

MR. DON BARTLES
P.O. BOX 11024
MARTINEZ, GA 30907

MR. LARRY MATTHEWS PE
GDOT ROUTE 2
4260 FRONTAGE ROAD
AUGUSTA, GA 30909

HON. TRAVIS BARNES
DISTRICT 90
407 AUMOND RD.
AUGUSTA, GA 30909

HON. DONALD CREEKS
DISTRICT 89
714 WESTMINSTER CT.
AUGUSTA, GA 30909

MILLARD GOODING
DIR. OF PUBLIC WORKS
RICHMOND COUNTY
RM. 704 MUNICIPAL BLDG
AUGUSTA, GA 30911

CO. ROAD SUPERINTENDENT
COURTHOUSE
ABBEVILLE, GA 31001

HON. HARRY WALKER CHM.
WILCOX CO. COMM.
COUNTY COURTHOUSE
ABBEVILLE, GA 31001

KENNETH HENRY
ASST. SUPT.
EMANUEL COUNTY
ROUTE 12
ADRIAN, GA 31002

JOHN NEELY
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BUTLER, GA 31006

COUNTY MANAGER
TAYLOR COUNTY
COUNTY COURTHOUSE
BUTLER, GA 31006

MARTIN MCGUFFIN
CO. ROAD SUPERINTENDENT
COURTHOUSE
BUTLER, GA 31006

HON. RUFUS GREEN CHM.
TAYLOR CO. COMM.
COUNTY COURTHOUSE
P. O. BOX 148
BUTLER, GA 31006

HON. JAMES SPILLERS
MAYOR
P.O. BOX 476
CITY HALL
BUTLER, GA 31006

HON. WARD EDWARDS
DISTRICT 112
P.O. BOX 145
BUTLER, GA 31006

MAYOR O. W. KITCHENS
P.O. BOX 36
BYRONVILLE, GA 31007

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CITY ENGINEER
CITY OF BYRON
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BYRON, GA 31008

MAYOR JAMES WILLIAMS
P.O. BOX 376
BYRON, GA 31008

STREET SUPERINTENDENT
P.O. BOX 8
COCHRAN, GA 31014

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
COCHRAN, GA 31014

HON. CHARLES KILLEBREW
MAYOR
P.O. BOX 8
CITY HALL
COCHRAN, GA 31014

CITY ENGINEER
P.O. BOX 569
CORDELE, GA 31015

HON. W. M. DAVIS JR. CHM.
CRISP CO. COMM.
COUNTY COURTHOUSE
CORDELE, GA 31015

DIRECTOR OF PUBLIC WORKS
COUNTY COURTHOUSE
CORDELE, GA 31015

HON. PERRY CULPEPPER
MAYOR
P.O. BOX 569
CITY HALL
CORDELE, GA 31015

HON. HOWARD RAINEY
DISTRICT 135
913 3RD AVE E
CORDELE, GA 31015

S. MARK MITCHELL
ASST. CITY MANAGER
CITY OF CORDELE
P. O. BOX 569
CORDELE, GA 31015

TOMMY TRUITT
PUBLIC WORKS SUPT.
CITY OF CULLODEN
PO BOX 38
CULLODEN, GA 31016

MAYOR CHARLES NORRIS
P.O. BOX 38
CULLODIN, GA 31016

MAYOR H. J. CHANCE
P.O. BOX 157
DANVILLE, GA 31017

HON. KENNETH McNERLY
MAYOR
P.O. BOX 534
CITY HALL
DAVISBORO, GA 31018

PUBLIC WORKS SUPT.
COURTHOUSE
DUBLIN, GA 31021

CITY ENGINEER
P.O. BOX 690
DUBLIN, GA 31021

HON. ALBERT FRANKS
MAYOR
P.O. BOX 690
CITY HALL
DUBLIN, GA 31021

HON. GEORGE GORNTO
MAYOR
119 SOPERTON AVE.
CITY HALL
EAST DUBLIN, GA 31021

HON. DUBOSE PORTER
DISTRICT 119
1701 BELLEVUE RD.
DUBLIN, GA 31021

CO. ROAD SUPERINTENDENT
BOX 564
EASTMAN, GA 31023

HON. GUY TRIPP CHM.
DODGE CO. COMM.
BOX 564
EASTMAN, GA 31023

JOE NELSON
STREET SUPT.
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EASTMAN, GA 31023

GREG IVEY
FOREMAN
CITY OF EASTMAN
PO BOX 40
EASTMAN, GA 31023

HON. MARVA McGRIFF
MAYOR
P.O. DRAWER 40
CITY HALL
EASTMAN, GA 31023

HON. TERRY COLEMAN
DISTRICT 118
P.O. BOX 157
EASTMAN, GA 31023

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EXECUTIVE DIRECTOR
HEART OF GEORGIA
501 OAK STREET
EASTMAN, GA 31023

CO. ROAD SUPERINTENDENT
COURTHOUSE
EATONTON, GA 31024

HON. ROY VINING JR. CHM.
PUTNUM CO. COMM.
COUNTY COURTHOUSE
EATONTON, GA. 31024

HON. J. P. MARSHALL
MAYOR
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CITY HALL
EATONTON, GA 31024

HON. JESSE COPELAN JR.
DISTRICT 106
P.O. BOX 109
EATONTON, GA 31024

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COUNTY COMMISSIONER
PUTNAM COUNTY
107 PINECREST DR.
EATONTON, GA 31024

HON. WALKER FOWLER
MAYOR
500 HOUSTON LAKE BLVD.
CITY HALL
CENTERVILLE, GA 31028

ELMO RICHARDSON
CITY ENGINEER
500 HOUSTON LAKE BLVD.
CENTERVILLE, GA 31028

J.D. BOLER
STREET SUPERINTENDENT
500 HOUSTON LAKE BLVD.
CENTERVILLE, GA 31028

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CO. ROAD SUPERINTENDENT
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ASA STUART
STREET SUPERINTENDENT
P.O. BOX 676
FORSYTH, GA 31029

HON. TOMMY WILSON CHM.
MONROE CO. COMM.
COUNTY COURTHOUSE
FORSYTH, GA 31029

HON. RICHARD TRUITT
MAYOR
P.O. BOX 1447
CITY HALL
FORSYTH, GA 31029

HON. KENNETH WALDREP
DIST 80 87 N LEE ST
P.O. BOX 657
FORSYTH, GA 31029

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COURTHOUSE
FORT VALLEY, GA 31030

MR. ALAN K. HARRIS
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PEACH TRANSIT SYSTEM
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FORT VALLEY, GA 31030

HON. GLENWOOD HILL
PEACH CO. COMM.
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FORT VALLEY, GA 31030

MR. JERRY C. BRYAN
COUNTY ENGINEER
P.O. BOX 468
FORT VALLEY, GA 31030

HON. C.W. PETERSON
MAYOR
P.O. BOX 956
CITY HALL
FORT VALLEY, GA 31030

HON. ROBERT RAY
DISTRICT 98
ROUTE 1
FORT VALLEY, GA 31030

HON. MICHAEL DENNIS
MAYOR
P.O. BOX 387
CITY HALL
GORDON, GA 31031

HON. KENNETH BIRDSONG
DISTRICT 104
ROUTE 1
GORDON, GA 31031

HON. BUTCH MOORE CHM.
JONES CO. COMM.
P.O. BOX 316
GRAY, GA 31032

MAYOR JAMES ROBERTS
P.O. BOX 443
GRAY, GA 31032

CO. ROAD SUPERINTENDENT
COURTHOUSE
GRAY, GA 31032

JAMES PITTMAN
CO. ROAD SUPERINTENDENT
COURTHOUSE
HAWKINSVILLE, GA 31036

STREET SUPERINTENDENT
315 BROAD STREET
HAWKINSVILLE, GA 31036

HON. JOHN H. ANDERSON CHM.
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COUNTY COURTHOUSE
HAWKINSVILLE, GA. 31036

MAYOR LAWRENCE BENNETT
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CITY HALL
HAWKINSVILLE, GA 31036

HON. TRUETTE HOWARD
MAYOR
P.O. BOX 222
CITY HALL
HELENA, GA 31037

RICK DUKE
GTRI
REGIONAL OFFICE
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MAYOR KAY ALBRITTON
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IDEAL, GA 31041

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COURTHOUSE
IRWINTON, GA 31042

HON. GUILFORD PAYNE CHM.
WILKINSON CO. COMM.
COUNTY COURTHOUSE
IRWINTON, GA 31042

WALTER PHILLIPS
CO. ROAD SUPERINTENDENT
COURTHOUSE
JEFFERSONVILLE, GA 31044

MAYOR W. E. HAMRICK
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JEFFERSONVILLE, GA 31044

HON. PERRY ATKINSON
CRAWFORD CO. COMM.
COUNTY COURTHOUSE
KNOXVILLE, GA 31050

MAYOR JOHN F. BRADLEY
LILLY, GA 31051

FRANCIS MCAFEE
CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
KNOXVILLE, GA 31052

HON. BILL CUMMINGS
DISTRICT 17
508 MORGAN VALLEY RD.
ROCKMART, GA 31053

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MCRAE, GA 31055

CO. ROAD SUPERINTENDENT
COURTHOUSE
MCRAE, GA 31055

HON. GENE WILLIAMS
TELFAR CO. COMM.
COUNTY COURTHOUSE
MCRAE, GA 31055

HON. CHESTER RYALS JR.
MAYOR
P.O. BOX 157
CITY HALL
MCRAE, GA 31055

HON. RONNIE WALKER
DISTRICT 19
P.O. BOX 461
MCRAE, GA 31055

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DIRECTOR
DEPT. OF GRANTS & RES
HOUSTON COUNTY
200 CARL VINSON PKY
WARNER ROBINS, GA 31056

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P.O. BOX 83
MARSHALLVILLE, GA 31057

STREET SUPERINTENDENT
P.O. BOX E
MILLEDGEVILLE, GA 31061

T. W. COUCH
ROAD SUPER'T
BALDWIN COUNTY
P.O. BOX 735
MILLEDGEVILLE, GA 31061

CO. ROAD SUPERINTENDENT
COURTHOUSE
MILLEDGEVILLE, GA 31061

HON. SAMMY HALL CHM.
BALDWIN CO. COMM.
COUNTY CRTHSE. Rm. 6
MILLEDGEVILLE, GA 31061

HON. JAMES BAUGH
MAYOR
P.O. BOX 1708
CITY HALL
MILLEDGEVILLE, GA 31061

HON. CULVER KIDD
DISTRICT 25
P.O. BOX 370
MILLEDGEVILLE, GA 31061

HON. BOBBY PARHAM
DISTRICT 105
P.O. BOX 606
MILLEDGEVILLE, GA 31061

MR. JIM GENTRY
EXECUTIVE DIRECTOR
OCONER APDC
P.O. BOX 707
MILLEDGEVILLE, GA 31061

WALTER BEN STORY
STREET SUPERINTENDENT
SOUTH DOOLY STREET
MONTEZUMA, GA 31063

MAYOR FRANK KELLEY
CITY OF MONTEZUMA
SOUTH DOOLY STREET
MONTEZUMA, GA 31063

HON. LEWIS MCKENZIE
DISTRICT 14
P.O. BOX 565
MONTEZUMA, GA 31063

STREET SUPERINTENDENT
P.O. BOX 269
MONTICELLO, GA 31064

CO. ROAD SUPERINTENDENT
COURTHOUSE
MONTICELLO, GA 31064

HON. FRANK ATKINS CHM.
JASPER CO. COMM.
COUNTY COURTHOUSE
MONTICELLO, GA 31064

HON. HENRY HOOPER
MAYOR
115 E. GREENE ST.
CITY HALL
MONTICELLO, GA 31064

ALBERT BOYLES
CO. ROAD SUPERINTENDENT
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MAYOR GERALD BECKUM
P.O. BOX 312
OGLETHORPE, GA 31068

HON. JOHN M. LUCKIE
COUNTY BOARD OF COMM.
P.O. BOX 297
OGLETHORPE, GA 31068

STREET SUPERINTENDENT
P.O. DRAWER A
PERRY, GA 31069

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CITY MANAGER
CITY OF PERRY
PO BOX A
PERRY, GA 31069

MR. WAYNE CHAPMAN
TRAFFIC CONTROL
HOUSTON CO. BOARD OF COMM.
2018 KINGS CHAPEL RD.
PERRY, GA 31069

MR. ELLIS E. SCAEBOROUGH
CO. ROAD SUPERINTENDENT
COURTHOUSE
PERRY, GA 31069

HON. LEWIS MEEKS
MAYOR
P.O. BOX A
CITY HALL
PERRY, GA 31069

HON. LARRY WALKER
DISTRICT 115
P.O. BOX 1234
PERRY, GA 31069

MAYOR GEORGE C. GRIGGS
P.O. BOX 118
PINEHURST, GA 31070

MAYOR DON E. BOND
CITY OF REYNOLDS
P.O. BOX 386
REYNOLDS, GA 31076

MAYOR JERRY WALKER
P.O. BOX 278
ROBERTA, GA 31078

HON. RALPH SUTTON
MAYOR
P.O. BOX 156
CITY HALL
ROCHELLE, GA 31079

RAY BLOODSWORTH
CHIEF OF POLICE
P.O. BOX 156
ROCHELLE, GA 31079

HON. W. N. HUDSON
DISTRICT 117
ROUTE 1 BOX 29A
ROCHELLE, GA 31079

STREET SUPERINTENDENT
P.O. BOX 71
SANDERSVILLE, GA 31082

CO. ROAD SUPERINTENDENT
COURTHOUSE
SANDERSVILLE, GA 31082

HON. T. M. DUKES CHM
WASHINGTON CO. COMM.
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SANDERSVILLE, GA 31082

HON. JIMMY LORD
DISTRICT 107
P.O. BOX 254
SANDERSVILLE, GA 31082

HAROLD BARLOW
COUNTY COMMISSIONER
P.O. BOX 816
SANDERSVILLE, GA 31082

HON. GEORGE LOTT CHM.
HANCOCK CO. COMM.
P.O. DRAWER I
SPARTA, GA 31087

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
SPARTA, GA 31087

MR. JACK COLLINS
STREET SUPT.
CITY OF SPARTA
PO BOX H
SPARTA, GA 31087

HON. T.M. PATTERSON SR.
MAYOR
P.O. BOX H
CITY HALL
SPARTA, GA 31087

CHARLES ALLEN
ROAD SUPT.
HANCOCK BOARD OF COMMISSIONERS
P.O. DRAWER I
SPARTA, GA 31087

MR. GEORGE LYONS
DISTRICT ENGINEER
GDOT DISTRICT 2
TENNILLE, GA 31089

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113 TANGLEWOOD DR.
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9219 MELODY DR.
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ROUTE 2
WEST GREEN, GA 31567

HON. HARRY CALLAHAN CHM.
CAMDEN CO. COMM.
COUNTY COURTHOUSE
WOODBINE, GA 31569

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
WOODBINE, GA 31569

COUNTY ENGINEER
P.O. BOX 1349
VALDOSTA, GA 31601

GRAYSON POWELL JR.
SOUTH GA. AREA
PLANNING & DEV. COMM.
P.O. BOX 1223
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WALTER WACTER
CHIEF DEPUTY
LOWNDES CO. SHERIFF
111 ROSWELL DR.
VALDOSTA, GA 31601

HON. FRED DELOACH CHM.
LOWNDES CO. COMM.
BOX 1349
VALDOSTA, GA 31601

HON. LOYCE TURNER
DISTRICT 8
P.O. BOX 157
VALDOSTA, GA 31601

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TRANSPORTATION PLANNER
SOUTH GEORGIA APDC
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HON. ARLIE WALKER CHM.
COOK CO. COMM.
COUNTY COURTHOUSE
ADEL, GA 31620

WAYNE GIDDENS
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STREET SUPERINTENDENT
200 W. DAME AVENUE
HOMERVILLE, GA 31634

HON. CHESTER DAY
MAYOR
200 WEST DAME AVE.
CITY HALL
HOMERVILLE, GA 31634

HON. JAMES SHAW
MAYOR
122 S. VALDOSTA RD.
CITY HALL
LAKELAND, GA 31635

HON. JERRY COFFEE
MAYOR
P.O. BOX 250
CITY HALL
MORVEN, GA 31638

HON. JOE STALLINGS CHM.
BERRIEN CO. COMM.
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NASHVILLE, GA 31639

CITY ENGINEER
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HON. ERNEST NIJEM
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COUNTY COURTHOUSE
ADEL, GA 31620

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HON. GEORGE SIRMANS CHM.
CLINCH CO. COMM.
COUNTY COURTHOUSE
HOMERVILLE, GA 31634

CO. ROAD SUPERINTENDENT
COURTHOUSE
LAKELAND, GA 31635

HON. ROBERT PATTEN
DISTRICT 149
ROUTE 1 BOX 180
LAKELAND, GA 31635

STREET SUPERINTENDENT
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NASHVILLE, GA 31639

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COUNTY COURTHOUSE
NASHVILLE, GA 31639

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ADEL, GA 31620

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102 SOUTH CHURCH ST.
CITY HALL
HAHIRA, GA 31632

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
HOMERVILLE, GA 31634

HON. JIM WHITE CHM.
LANIER CO. COMM.
COUNTY COURTHOUSE
LAKELAND, GA 31635

GRADY BRYAN JR.
TRAFFIC SIGNAL TECH.
GA. DOT
RT 1 BOX 1
LENOX, GA 31637

EVELYN BALDREE
COMMUNITY SERVICE
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NASHVILLE, GA 31639

HON. DEWEY HAND
MAYOR
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CITY HALL
NASHVILLE, GA 31639

HON. HANSON CARTER
DISTRICT 146
P.O. BOX 711
NASHVILLE, GA 31639

HON. ED PERRY
DISTRICT 7
ROUTE 2
NASHVILLE, GA 31639

JOHNNY ROSS
ROAD SUPT.
BERRIEN COUNTY
NASHVILLE, GA 31639

CO. ROAD SUPERINTENDENT
P.O. BOX 518
PEARSON, GA 31642

HON. HORACE McKINNON CHM.
ATKINSON CO. COMM.
COUNTY COURTHOUSE
PEARSON, GA 31642

HON. FOSTER DAVIS
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CITY HALL
PEARSON, GA 31642

STREET SUPERINTENDENT
P.O. BOX 208
QUITMAN, GA 31643

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
QUITMAN, GA 31643

HON. H. C. SCRUGGS CHM.
BROOKS CO. COMM.
COUNTY COURTHOUSE
QUITMAN, GA 31643

HON. WAYNE CARROLL
MAYOR
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CITY HALL
QUITMAN, GA 31643

HON. HENRY REAVES
DISTRICT 147
ROUTE 2
QUITMAN, GA 31643

JUANELLE S. WILSON
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RAY CITY, GA 31645

CO. ROAD SUPERINTENDENT
COURTHOUSE
STATENVILLE, GA 31648

HON. DAN DELOACH CHM.
ECHOLS CO. COMM.
COUNTY COURTHOUSE
STATENVILLE, GA 31648

HON. CHARLES HATCHER
US REP 2ND DIST
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ROOM 201
PO BOX 1932
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HON. TOMMY CHAMBLESS
DISTRICT 133
P.O. BOX 2008
ALBANY, GA 31702

HON. AL HOLLAWAY
DISTRICT 12
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HON. JOHN WHITE
DISTRICT 132
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SW GEORGIA AREA OFFICE
GEORGIA TECH
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AMERICUS, GA 31709

CITY ENGINEER
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AMERICUS, GA 31709

HON. J. WADE HALSTEAD CHM.
SUMTER CO. COMM.
COUNTY COURTHOUSE
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AMERICUS, GA 31709

HON. RUSSELL THOMAS
MAYOR
P.O. BOX M
CITY HALL
AMERICUS, GA 31709

HON. GEORGE HOOKS
DISTRICT 116
P.O. BOX 928
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CALHOUN CO. COMM.
COUNTY COURTHOUSE
ARLINGTON, GA 31713

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ARLINGTON, GA 31713

CO. ROAD SUPERINTENDENT
COURTHOUSE
ASHBURN, GA 31714

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ASS'T CHIEF
ASHBURN POLICE DEPT.
EAST MONROE AVE.
ASHBURN, GA 31714

CITY ENGINEER
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HON. BENNY DENHAM CHM.
TURNER CO. COMM.
COUNTY COURTHOUSE
ROUTE 2
ASHBURN, GA 31714

HON. J. I. YOUNGBLOOD
MAYOR
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CITY HALL
ASHBURN, GA 31714

CITY ENGINEER
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BAINBRIDGE, GA 31717

COUNTY ENGINEER
COURTHOUSE
BAINBRIDGE, GA 31717

HON. CLIFFORD DOLLAR CHM.
DECATUR CO. COMM.
COUNTY COURTHOUSE
BAINBRIDGE, GA 31717

HON. BILL E. REYNOLDS
MAYOR
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CITY HALL
BAINBRIDGE, GA 31717

HON. WALTER COX
DISTRICT 141
202 WEST ST.
BAINBRIDGE, GA 31717

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DEPUTY WARDEN
CORRECTIONAL INST.
DECATUR COUNTY
ROUTE #3 BOX 1218
BAINBRIDGE, GA 31717

STREET SUPERINTENDENT
P.O. BOX 350
BLAKELY, GA 31723

CO. ROAD SUPERINTENDENT
P.O. BOX 525
BLAKELY, GA 31723

HON. ROSCELL ELLIS CHM.
EARLY CO. COMM.
COUNTY COURTHOUSE
BLAKELY, GA 31723

HON. JAMES RICHARDSON
MAYOR
P.O. BOX 350
CITY HALL
BLAKELY, GA 31723

HON. RALPH BALECOM
DISTRICT 140
ROUTE 1
BLAKELY, GA 31723

HON. JIMMY TIMMONS
DISTRICT 11
132 S WOODLAWN ST
BLAKELY, GA 31723

WAYLON LACEY
CITY ENGINEER
CITY OF BLAKELY
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BLAKELY, GA 31723

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P.O. BOX 29
CAIRO, GA 31728

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COUNTY ADMINISTRATOR
GRADY COUNTY
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CAIRO, GA 31728

HON. KELSO COOPER CHM.
GRADY CO. COMM.
COUNTY COURTHOUSE
CAIRO, GA 31728

CO. ROAD SUPERINTENDENT
P.O. BOX 90
CAIRO, GA 31728

HON. FRANK CANNON JR.
MAYOR
P.O. BOX 29
CITY HALL
CAIRO, GA 31728

HON. BOBBY LONG
DISTRICT 142
1466 6TH ST. NW
CAIRO, GA 31728

CO. ROAD SUPERINTENDENT
COURTHOUSE
CAMILLA, GA 31730

JAMES W. DAVIS
RFD #2
CAMILLA, GA 31730

WILLIAM BARTON
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CAMILLA, GA 31730

STREET SUPERINTENDENT
P.O. BOX 328
CAMILLA, GA 31730

HON. CHARLES LODGE CHM.
MITCHELL CO. COMM.
COUNTY COURTHOUSE
CAMILLA, GA 31730

HON. A. A. McNEIL JR.
MAYOR
P.O. BOX 328
CITY HALL
CAMILLA, GA 31730

MS. CARROLL UNDERWOOD
EXECUTIVE DIRECTOR
SOUTHWEST GEORGIA APDC
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CAMILLA, GA 31730

HON. PAUL TRULOCK
DISTRICT 10
P.O. BOX 68
CLIMAX, GA 31734

CO. ROAD SUPERINTENDENT
COURTHOUSE
COLQUITT, GA 31737

STREET SUPERINTENDENT
154 E. COLLEGE STREET
COLQUITT, GA 31737

HON. B. A. JONES JR. CHM.
MILLER CO. COMM.
COUNTY COURTHOUSE
COLQUITT, GA 31737

HON. HENRY COOK
MAYOR
154 E. COLLEGE AVE.
CITY HALL
COLQUITT, GA 31737

HON. ALLEN SHERROD
DISTRICT 143
ROUTE 1
COOLIDGE, GA 31738

CO. ROAD SUPERINTENDENT
COURTHOUSE
CUTHBERT, GA 31740

CITY ENGINEER
P.O. BOX 6
CUTHBERT, GA 31740

HON. R. W. MOORE CHM.
RANDOLPH CO. COMM.
COUNTY COURTHOUSE
CUTHBERT, GA 31740

HON. FELIX RIVERS JR.
MAYOR
P.O. BOX 6
CITY HALL
CUTHBERT, GA 31740

HON. GERALD GREENE
DISTRICT 130
RT. 3 BOX 119
CUTHBERT, GA 31740

CO. ROAD SUPERINTENDENT
COURTHOUSE
DAWSON, GA 31742

DOROTHY WARD
TRANSPORTATION COORDINATOR
433 SOUTH OAK STREET
DAWSON, GA 31742

CITY ENGINEER
P.O. BOX 190
DAWSON, GA 31742

TERRELL-LEE MENTAL
RETARDATION SER. CTR.
508 OAK STREET S.E.
DAWSON, GA 31742

HON. WILBUR GAMBLE CHM.
TERRELL CO. COMM.
COUNTY COURTHOUSE
DAWSON, GA 31742

HON. JAMES BAINES
MAYOR
P.O. BOX 190
CITY HALL
DAWSON, GA 31742

CO. ROAD SUPERINTENDENT
COURTHOUSE
DONALSONVILLE, GA 31745

CITY ENGINEER
P.O. BOX 308
DONALSONVILLE, GA 31745

HON. JACK BRANNON CHM.
SEMINOLE CO. COMM.
COUNTY COURTHOUSE
DONALSONVILLE, GA 31745

HON. H. M. SHINGLER
MAYOR
P.O. BOX 308
CITY HALL
DONALSONVILLE, GA 31745

CITY ENGINEER
CITY HALL
FITZGERALD, GA 31750

HON. ED DREXLER CHM.
BEN HILL CO. COMM.
P.O. BOX 300
FITZGERALD, GA 31750

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
FITZGERALD, GA 31750

HON. GERALD THOMPSON
MAYOR
MUNICIPAL BLDG.
FITZGERALD, GA 31750

HON. PAUL BRANCH JR.
DISTRICT 137
ROUTE 4 BOX 493A
FITZGERALD, GA 31750

HON. GERALD ISLER CHM.
CLAY CO. COMM.
COUNTY COURTHOUSE
FORT GAINES, GA 31751

CINDY ANDERSON
DIRECT SERVICES CORP.
P.O. BOX 443
FORT GAINES, GA 31751

CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
FORT GAINES, GA 31751

CO. ROAD SUPERINTENDENT
COURTHOUSE
GEORGETOWN, GA 31754

HON. HARRY CLANCE CHM.
QUITMAN CO. COMM.
COUNTY COURTHOUSE
GEORGETOWN, GA 31754

HON. GERALD DEAN
MAYOR
P.O. BOX 200
LEARY, GA 31762

CO. ROAD SUPERINTENDENT
COURTHOUSE
LEESBURG, GA 31763

HON. A. M. BRUNER CHM.
LEE CO. COMM.
BOX 56
LEESBURG, GA 31763

MAYOR W. T. ANDERSON
P.O. BOX 278
LESLIE, GA 31764

CO. ROAD SUPERINTENDENT
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MORGAN, GA 31766

CITY ENGINEER
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ROBERT COBB
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COUNTY ENGINEER
P.O. BOX 1305
MOULTRIE, GA 31768

HON. BILL McINTOSH
MAYOR
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CITY HALL
MOULTRIE, GA 31768

HON. HUGH MATTHEWS
DISTRICT 145
ROUTE 1 BOX 913
MOULTRIE, GA 31768

CO. ROAD SUPERINTENDENT
COUNTY FARM
NEWTON, GA 31770

HON. L. R. HEARD CHM.
BAKER CO. COMM.
COUNTY COURTHOUSE
NEWTON, GA 31770

HON. J. W. HENDRICKS
MAYOR
MAIN STREET
CITY HALL
NEWTON, GA 31770

STREET SUPERINTENDENT
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CO. ROAD SUPERINTENDENT
COURTHOUSE
OCILLA, GA 31774

HON. J. C. HARPER CHM.
IRWIN CO. COMM.
BOX 287
OCILLA, GA 31774

HON. DAVID SMITH
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CITY HALL
OCILLA, GA 31774

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CITY SUPT.
CITY OF OMEGA
P.O. BOX 6
OMEGA, GA 31775

ERVIN CASTEBERRY Jr.
ROAD MAINT.
CITY OF OMEGA
P.O. BOX 6
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CITY ENGINEER
CITY OF MOULTRIE
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MR. CHARLES WEATHERS
SUPT. OF ROADS & BRIDGES
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DISTRICT 131
ROUTE 1
PARROTT, GA 31777

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PELHAM, GA 31779

HON. MARCUS COLLINS SR.
DISTRICT 144
ROUTE 1 BOX 107
PELHAM, GA 31779

RALPH COLLINS
MITCHELL COUNTY COMM.
BOX 96
PELHAM, GA 31779

MAYOR RALPH McDONALD
P.O. BOX 387
PLAINS, GA 31780

HON. TOM FAIRCLOTH
MAYOR
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CITY HALL
THOMASVILLE, GA 31782

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CHIEF OF POLICE
SYLVESTER POLICE DEPT.
P.O. BOX 368
SYLVESTER, GA 31791

CO. ROAD SUPERINTENDENT
COURTHOUSE
SYLVESTER, GA 31791

HON. W. W. MIMS CHM.
WORTH CO. COMM.
COUNTY COURTHOUSE
SYLVESTER, GA 31791

HON. OREN HARDEN JR.
MAYOR
P.O. BOX 368
CITY HALL
SYLVESTER, GA 31791

HON. EARLEEN SIZEMORE
DISTRICT 136
ROUTE 3 BOX 47D
SYLVESTER, GA 31791

CITY ENGINEER
144 E. JACKSON ST.
THOMASVILLE, GA 31792

COUNTY ENGINEER
COURTHOUSE
THOMASVILLE, GA 31792

HON. JOHN BULLOCH CHM.
THOMAS CO. COMM.
COUNTY COURTHOUSE
THOMASVILLE, GA 31792

MRS CARLA WILLET
710 WEST 2ND STREET
TIFTON, GA 31793

MR. DONALD SENEDELL
DISTRICT ENGINEER
GEORGIA DOT
710 WEST 2ND STREET
TIFTON, GA 31793

MILDRED B. KRIGANS
TRAINING OFFICER
710 WEST 2ND. ST.
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COMM. DEVELOPMENT
TIFT CO. COMM.
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DARRELL WIGGINS
DIRECTOR OF PLANNING
TIFT COUNTY
P.O. BOX 826
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HARRY BOSS
TIFT COUNTY
P. O. BOX 826
TIFTON, GA 31793

STREET SUPERINTENDENT
P.O. BOX 229
TIFTON, GA 31794

CO. ROAD SUPERINTENDENT
COURTHOUSE
TIFTON, GA 31794

HON. CHARLES KENT CHM.
TIFT CO. COMM.
COUNTY COURTHOUSE
TIFTON, GA 31794

HON. FRANK RALEY CHM.
TIFTON CITY COMM.
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TIFTON, GA 31794

HON. HENRY BOSTICK
DISTRICT 138
P.O. BOX 94
TIFTON, GA 31794

RAINEY WELCH
CO. ROAD SUPERINTENDENT
COURTHOUSE
BUENA VISTA, GA 31803

HON. BETTY BARWICK CHM.
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BUENA VISTA, GA 31803

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CHATTAHOOCHEE CO. COMM.
COUNTY COURTHOUSE
CUSSETA, GA 31805

MAYOR J. E. SMITH
P.O. BOX 216
CUSSETA, GA 31805

EDWARD BAKER
CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
CUSSETA, GA 31805

CO. ROAD SUPERINTENDENT
COURTHOUSE
ELLAVILLE, GA 31806

CITY ENGINEER
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ELLAVILLE, GA 31806

MAYOR JEANETTE PEEDE
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ELLAVILLE, GA 31806

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SCHLEY CO. COMM.
COUNTY COURTHOUSE
ELLAVILLE, GA 31806

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MIDDLE FLINT APDC
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HARRIS CO. COMM.
COUNTY COURTHOUSE
HAMILTON, GA 31811

JIMMY EVANS
CO. ROAD SUPERINTENDENT
COUNTY COURTHOUSE
HAMILTON, GA 31811

HON. BEN H. PENTON
COUNTY MANAGER
HARRIS COUNTY
PO BOX 365
HAMILTON, GA 31811

MAYOR HENRY CRVE
P.O. BOX 112
HAMILTON, GA 31811

MAYOR M. J. HESTERS
TOWN OF JUNCTION CITY
JUNCTION CITY, GA 31812

CO. ROAD SUPERINTENDENT
COURTHOUSE
LUMPKIN, GA 31815

MAYOR W. E. CANNINGTON
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SITE MANAGER
SENIOR CITIZEN CENTER
STEWART COUNTY
P.O. BOX 1097
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HON. PERRY USHER
STEWART CO. COMM.
COUNTY COURTHOUSE
LUMPKIN, GA 31815

MAYOR PHILIP RUDDERMAN
CHAIRMAN
122 SECOND STREET
CITY HALL
MANCHESTER, GA 31816

RALPH PEARSON
STREET SUPT.
CITY OF MANCHESTER
122 2ND ST.
MANCHESTER, GA 31816

HON. CLAUDE BRAY JR.
DISTRICT 91
P.O. BOX 549
MANCHESTER, GA 31816

MAYOR E. C. COTTON JR.
P.O. BOX 100
OMAHA, GA 31821

MAYOR JAMES EDGAR
P.O. BOX 2
PINE MOUNTAIN, GA 31822

CO. ROAD SUPERINTENDENT
COURTHOUSE
PRESTON, GA 31824

MAYOR O. L. MONTGOMERY
P.O. BOX 37
PRESTON, GA 31824

HON. LUCIUS BLACK
WEBSTER CO. COMM.
COUNTY COURTHOUSE
PRESTON, GA 31824

HON. ADOLPH MCLENDON
MAYOR
P.O. BOX 126
CITY HALL
RICHLAND, GA 31825

HON. ROY D. MOULTRIE
DISTRICT 93
ROUTE 1
SHILOH, GA 31826

MAYOR RANDOLPH PHILLIPS
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SHILOH, GA 31826

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COURTHOUSE
TALBOTTON, GA 31827

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COUNTY CLERK
TALBOT COUNTY
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HON. FREEMAN MONTGOMERY CHM.
TALBOT CO. COMM.
COUNTY COURTHOUSE
TALBOTTON, GA 31827

CHIEF JAMES C.
CHIEF OF POLICE
TALBOTTON POLICE DEPT.
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TALBOTTON, GA 31827

MAYOR JOE BUTTS
P.O. BOX 156
WARM SPRINGS, GA 31830

MAYOR THOMAS PERKINS
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WAVEBLY HALL, GA 31831

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30. TORT LIABILITY
31. HYDROLOGY
32. COMPUTERS, HARDWARE, ETC.
33. FREIGHT TRANSPORTATION
34. ALCOHOL
35. OTHER

A BASIC ASPHALT EMULSION MANUAL

- THE ASPHALT INSTITUTE, 1980 115+ BOX
Agency - 6 Subject - 6 Newsletter - 9

ABSTRACTS 1984

- UMTA , 1984 40+ 3
Agency - 1 Subject - 1 Newsletter - 0

ABSTRACTS 1983

- UMTA , 1983 60+ 3
Agency - 1 Subject - 1 Newsletter - 0

ABSTRACTS 1982

- UMTA , 1984 20+ 1
Agency - 1 Subject - 1 Newsletter - 0

ACCESS: BROKERING PARATRANSIT SERVICES TO THE ELDERLY AND HANDICAPPED IN ALLEGHENY COUNTY PA

- UMTA , 1984 162 1
Agency - 1 Subject - 23 Newsletter - 0

ACCIDENT RESEARCH MANUAL

- FHWA , 1980 136+ 1
Agency - 6 Subject - 2 Newsletter - 12

ACCOUNTING WITH LOTUS 1-2-3

- WADSWORTH , 1983 276 1
Agency - 28 Subject - 32 Newsletter - 0

A COMMUNITY MODEL FOR HANDLING HAZARDOUS MATERIAL TRANSPORTATION EMERGENCIES

- USDOT , 1986 15 1
Agency - 24 Subject - 3 Newsletter - 0

A DIGEST OF STATE ALCOHOL-HIGHWAY SAFETY RELATED LEGISLATION

- NHTSA , 1983 312 2
Agency - 2 Subject - 2 Newsletter - 0

A GUIDE FOR USERS

- UMTA , 1984 26 1
Agency - 1 Subject - 1 Newsletter - 7

A GUIDE TO SELF SUFFICIENT FUNDING OF ALCOHOL
TRAFFIC SAFETY PROGRAMS

- NHTSA , 1983 46 1
Agency - 2 Subject - 34 Newsletter - 0

A GUIDE TO THE FEDERAL HAZARDOUS MATERIALS
TRANSPORTATION REGULATORY PROGRAM

- MTB , 1983 53 1
Agency - 3 Subject - 3 Newsletter - 0

A GUIDE TO THE USE OF DISSEMINATION
TECHNIQUES FOR TRANSPORTATION INFORMATION

- RSPA , 1983 146+ 2
Agency - 4 Subject - 4 Newsletter - 0

AIRPORT GROUND TRANSPORTATION:
PROBLEMS AND SOLUTIONS

- AGTA , 1981 155+ 1
Agency - 5 Subject - 5 Newsletter - 0

ALTERNATE HIGHWAY DECIDING CHEMICALS

- FHWA , 1980 16+ 1
Agency - 6 Subject - 6 Newsletter - 0

AMERICA ON THE MOVE

- FHWA , 1984 32 2
Agency - 27 Subject - 6 Newsletter - 0

AMERICA'S HIGHWAYS: ACCELERATING THE SEARCH FOR INNOVATION

- TRB , 1984 169 1
Agency - 25 Subject - 27 Newsletter - 0

A METHOD FOR WETLAND FUNCTIONAL
ASSESSMENT VOL.1

- FHWA , 1983 125+ 1
Agency - 6 Subject - 7 Newsletter - 3

A METHOD FOR WETLAND FUNCTIONAL
ASSESSMENT VOL.2

- FHWA , 1983 120+ 1
Agency - 6 Subject - 7 Newsletter - 3

ANALYSIS OF COMMUTER RAIL COSTS AND
COST ALLOCATION METHODS

- UMTA , 1983 80+ 1
Agency - 1 Subject - 1 Newsletter - 0

ANNUAL PROGRESS REPORT

- FHWA , 1984 62 1
Agency - 6 Subject - 17 Newsletter - 0

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- UNC INSTITUTE FOR TRANS RESEARCH AND EDUCATION, 1985 16 1
Agency - 38 Subject - 17 Newsletter - 0

A PAVEMENT MOISTURE ACCELERATED DISTRESS (MAD) IDENTIFICATION SYSTEM VOL.1

- FHWA , 1981 135+ 1
Agency - 6 Subject - 6 Newsletter - 0

A PAVEMENT MOISTURE ACCELERATED DISTRESSES (MAD) IDENTIFICATION SYSTEM VOL.2

- FHWA , 1981 227+ 1
Agency - 6 Subject - 6 Newsletter - 0

APPLICATION OF ADHESIVES TO STEEL BRIDGES

- FHWA , 1984 176 1
Agency - 6 Subject - 12 Newsletter - 0

A PREVENTIVE MAINTENANCE MANAGEMENT SYSTEM FOR LOCAL GOVERNMENTS

- GA TECH , 1982 30+ 1
Agency - 7 Subject - 8 Newsletter - 0

A PRIMER ON WASTEWATER TREATMENT

- EPA , 1976 28 1
Agency - 30 Subject - 35 Newsletter - 0

A PROCEDURE FOR DETERMINING FREQUENCIES TO INSPECT AND REPAIR HIGHWAY SAFETY HARDWARE

- FHWA , 1983 17+ 1
Agency - 6 Subject - 2 Newsletter - 6

ASSESSMENT OF THE IMPACTS OF THE NATIONAL FLOOD INSURANCE PROGRAM ON HIGHWAYS

- FHWA , 1980 66 1
Agency - 6 Subject - 35 Newsletter - 0

ASPHALT SURFACE TREATMENTS CONSTRUCTION TECHNIQUES

- ASPHALT INSTITUTE , 1982 28 1
Agency - 36 Subject - 6 Newsletter - 0

ASPHALT SURFACT TREATMENTS SPECIFICATIONS

- ASPHALT INSTITUTE , 1982 8 1
Agency - 36 Subject - 6 Newsletter - 0

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- HERPICC PURDUE UNIV, 1983 42 2
Agency - 8 Subject - 9 Newsletter - 6

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- FHWA , 1984 64 1
Agency - 6 Subject - 27 Newsletter - 0

BRIDGE FORMULA APPLICATION VOL.I

- FHWA , 1984 71 1
Agency - 6 Subject - 12 Newsletter - 0

BUS ROUTE DEMAND MODELS

- SG ASS. INC BOSTON, 1983 109 1
Agency - 1 Subject - 1 Newsletter - 0

BY LAND/SEA/AND AIR

- GEORGIANS FOR BETTER TRANSPORTATION , 1983 50 1
Agency - 30 Subject - 35 Newsletter - 0

CALIBRATION PROCEDURES FOR ROADMETERS

- , 1986 79 1
Agency - 6 Subject - 19 Newsletter - 0

CALIFORNIA FLEXIBLE PAVEMENT MANAGEMENT SYSTEM

- FHWA , 1984 60 1
Agency - 6 Subject - 32 Newsletter - 0

CANDIDATE SIGNAL WARRANTS FROM GAP DATA

- FHWA , 1983 73 1
Agency - 6 Subject - 10 Newsletter - 0

CASE STUDIES USING EARDMAR FHWA-TS-84-219

- FHWA , 1984 160 1
Agency - 6 Subject - 19 Newsletter - 9

CENTRIFUGAL TESTING OF MODEL PILES AND PILE GROUPS

- FHWA , 1984 44 1
Agency - 6 Subject - 18 Newsletter - 0

CHECKLIST FOR PREPARING BASIC MOTOR GRADER (29000 LBS. CLASS) SPECIFICATIONS

- PURDUE UNIV , 1983 8 1
Agency - 8 Subject - 11 Newsletter - 0

CHEMICAL COMPOSITION OF ASPHALT AS RELATED TO ASPHALT DURABILITY

- FHWA , 1984 35+ 1
Agency - 6 Subject - 6 Newsletter - 9

CODE OF FEDERAL REGULATIONS

- FHWA , 1984 20 1
Agency - 6 Subject - 28 Newsletter - 0

COMMUTER AND EXPRESS BUS SERVICE IN THE SCAG REGION

- SCAG TRANSIT SECTION , 1982 58+ 1
Agency - 1 Subject - 1 Newsletter - 0

COMPARISON OF THREE COMPACTORS USED IN POTHOLE REPAIR

- COLD REGIONS LAB , 1984 14 14
Agency - 6 Subject - 21 Newsletter - 14

COMPILATION OF STATE LAWS AND REGULATIONS ON MATTERS AFFECTING RAIL HIGHWAY CROSSINGS

- ASS OF AMER RR , 1983 425+ 1
Agency - 9 Subject - 2 Newsletter - 4

COMPUTERIZED SIGNAL SYSTEMS: OVERVIEW AND PRODUCT SUMMARIES

- FHWA , 1982 100+ 1
Agency - 6 Subject - 10 Newsletter - 0

CONNECTIONS FOR MODULAR PRECAST CONCRETE BRIDGE DECKS

- THE CONSULTING ENGINEERS GROUP INC. IL, 1983 107+ 1
Agency - 6 Subject - 12 Newsletter - 0

CONSUMER INFORMATION CATALOG

- CONSUMER INFORMATION CENTER , 1986 16 1
Agency - 37 Subject - 24 Newsletter - 0

COORDINATION OF TRANSPORTATION RESOURCES: THE GEORGIA EXPERIENCE

- GDOT , 1985 17 1
Agency - 15 Subject - 4 Newsletter - 0

COSMIC SOFTWARE CATALOG

- NASA , 1984 350 1
Agency - 32 Subject - 22 Newsletter - 0

COUNTY STORM DRAINAGE MANUAL

- PURDUE UNIV , 1981 300+ 2
Agency - 8 Subject - 13 Newsletter - 0

CULVERT INSPECTION MANUAL

- FHWA , 1986 205 5
Agency - 6 Subject - 12 Newsletter - 16

DECAY IN WOOD BRIDGES

- CLARK AND ESLYN USDA, 1983 49+ 17
Agency - 10 Subject - 12 Newsletter - 14

DECISION PROCEDURES IN TRANSIT
STATION DESIGN

- UNIV OF VIRGINIA , 1981 59 1
Agency - 4 Subject - 1 Newsletter - 0

DESCRIPTIONS OF TRANSIT MAINTENANCE MANAGEMENT
INFORMATION SYSTEMS UMTA

- , 1984 277 1
Agency - 1 Subject - 1 Newsletter - 0

DESIGN EXAMPLES FOR STEEL BOX GIRDERS

- FHWA , 1986 50+ 1
Agency - 6 Subject - 12 Newsletter - 15

DESIGN GUIDELINES FOR RAISED AND TRAVERSABLE
MEDIANS IN URBAN AREAS

- UNIV OF VA AND VADOT , 1983 44+ 1
Agency - 27 Subject - 22 Newsletter - 0

DESIGN TECHNICAL BULLETINS

- INT SLURRY SEAL ASSOCIATION , 1984 75+ 1
Agency - 41 Subject - 6 Newsletter - 0

DETERMINATION OF PEAK DISCHARGE AND DESIGN
HYDROGRAPHS FOR SMALL WATERSHEDS IN INDIANA

- PURDUE UNIV , 1964 106 1
Agency - 8 Subject - 13 Newsletter - 0

DEVELOPMENT OF A HIGH PRESSURE WATER JET FOR
THE RAPID REMOVAL OF CONCRETE

- DAEDALEAN ASS INC. MD, 1983 52+ 1
Agency - 6 Subject - 14 Newsletter - 0

DEVELOPMENT OF A MAINTENANCE MANAGEMENT
SYSTEM FOR GA COUNTIES

- UNIV GA , 1975 59 1
Agency - 11 Subject - 8 Newsletter - 0

DEVELOPMENT OF THE CALIFORNIA PAVEMENT
MANAGEMENT SYSTEM VOL.1

- CA DOT , 1978 198+ 2
Agency - 6 Subject - 6 Newsletter - 0

DEVELOPMENT OF THE CALIFORNIA PAVEMENT
MANAGEMENT SYSTEM VOL.2

- CA DOT , 1978 59 1
Agency - 6 Subject - 6 Newsletter - 0

DIAMOND INTERCHANGE PROGRAM
USERS MANUAL

- CALTRANS , 1980 80+ 2
Agency - 6 Subject - 10 Newsletter - 0

DIGEST OF INFORMATION ON
SUPER WATER REDUCERS

- EXPERIMENTAL PROJECTS PROGRAM , 1984 21 1
Agency - 14 Subject - 6 Newsletter - 0

DITCH WITCH

- CHARLES MACHINE WORKS , 1986 100+ 1
Agency - 34 Subject - 11 Newsletter - 0

DRAINAGE OF HIGHWAY PAVEMENTS

- TYE ENG INC VA, 1984 136 2
Agency - 6 Subject - 13 Newsletter - 6

DURABLE PAVEMENT MARKING MATERIALS
WORKSHOPS

- DINGLE ASS. INC DC, 1981 19 1
Agency - 6 Subject - 16 Newsletter - 0

DUST CONTROL ON UNPAVED ROADS

- PUDUE UNIV , 1959 18+ 1
Agency - 8 Subject - 15 Newsletter - 0

EFFECTS OF CONSTRUCTION PROCEDURES ON BOND IN BRIDGE DECKS

- UNIV KANSAS , 1983 28 1
Agency - 12 Subject - 12 Newsletter - 0

EFFECTS OF TRAFFIC INDUCED VIBRATIONS ON BRIDGE DECK REPAIRS

- UNIV KANSAS , 1983 22 1
Agency - 12 Subject - 12 Newsletter - 0

EFFECTS OF TAXI REGULATORY REVISION IN SAN DIEGO CA

- DE LEUW CATHER & CO CA, 1983 216+ 1
Agency - 1 Subject - 1 Newsletter - 0

EFFECTS OF TAXI REGULATORY REVISION IN SEATTLE WASH

- DE LEUW CATHER & CO CA, 1983 160+ 1
Agency - 1 Subject - 1 Newsletter - 0

ENGINEERED WOOD TROSSES

- SE TRUSS MAN. ASS. , 1983 28 1
Agency - 13 Subject - 12 Newsletter - 0

EPOXY THERMOPLASTIC (ETP) PAVEMENT MARKING MATERIAL

- FHWA , 1983 2 6
Agency - 6 Subject - 6 Newsletter - 0

EPOXY THERMOPLASTIC TRAFFIC MARKING MATERIAL

- FHWA , 1982 53 1
Agency - 6 Subject - 6 Newsletter - 0

EVALUATION OF SNOWPLOWABLE MARKERS

- UNIV KENTUCKY , 1982 36 3
Agency - 6 Subject - 16 Newsletter - 0

EVALUATION OF STREETER AMET 13 CHANNEL VEHICLE TYPE PROGRAM

- KANSAS DOT, 1985 11 1
Agency - 9 Subject - 12 Newsletter - 0

EVALUATION WORKBOOK FOR PUBLIC
SAFETY MANAGERS

- VIRGINIA COMM UNIV , 1982 26 1
Agency - 24 Subject - 2 Newsletter - 0

EXCELLANCE IN HIGHWAY DESIGN

- FHWA , 1984 20 1
Agency - 27 Subject - 6 Newsletter - 0

FEDERALLY COORDINATED PROGRAM OF HIGHWAY
RESEARCH AND DEVELOPMENT

- OFFICES OF RES DEV & TECH D.C., 1982 40 3
Agency - 6 Subject - 17 Newsletter - 0

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RESEARCH DEVELOPMENT AND TECHNOLOGY

- OFFICES OF RES DEV & TECH D.C., 1984 400+ 6
Agency - 6 Subject - 17 Newsletter - 0

FEDERAL LAWS AND MATERIALS RELATING TO
THE FEDERAL HIGHWAY ADMINISTRATION

- FHWA , 1983 4 1
Agency - 6 Subject - 28 Newsletter - 0

FEDERAL REGISTER

- DOT , 1980 21 1
Agency - 24 Subject - 17 Newsletter - 0

FIELD EVALUATION OF A GENERIC THERMOPLASTIC PAVEMENT MARKING MATERIAL

- FHWA , 1984 20 1
Agency - 6 Subject - 16 Newsletter - 0

FIELD EVALUATION OF AN IMPACT TESTING
DEVICE FOR MEASURING BASE COURSE STRENGTH

- PURDUE UNIV , 1983 78 1
Agency - 8 Subject - 18 Newsletter - 0

FIELD MAINTENANCE MANUAL FOR GA COUNTIES
LOCAL ROADS AND STREETS

- GA TECH , 1975 184+ 20
Agency - 15 Subject - 19 Newsletter - 12

FIELD MANUAL ON DESIGN AND
CONSTRUCTION OF SEAL COATS

- US DOT , 1981 84 1
Agency - 24 Subject - 19 Newsletter - 0

FIELD TEST OF THE GRADE SEVERITY RATING SYSTEM

- FHWA , 1986 50 1
Agency - 6 Subject - 22 Newsletter - 0

FINANCIAL ASSISTANCE GUIDELINES

- FEMA , 1984 150+ 1
Agency - 14 Subject - 8 Newsletter - 0

FINANCING RURAL ROADS AND BRIDGES

- USDA , 1984 225 2
Agency - 10 Subject - 26 Newsletter - 0

FLEXIBLE DELINEATOR POST TEST PROCEDURES FHWA-TS-84-225

- FHWA , 1984 85 1
Agency - 6 Subject - 2 Newsletter - 10

FLEXIBLE PAVEMENT MANAGEMENT SYSTEM MICROCOMPUTER PROGRAM BASED ON CALIFORNIA PMS

- CALTRANS , 1981 15+ 1
Agency - 6 Subject - 8 Newsletter - 0

FLEXIBLE PARKING REQUIREMENTS

- PUBLIC TECH INC. D.C., 1982 15+ 1
Agency - 24 Subject - 20 Newsletter - 0

FLY ASH FACTS FOR HIGHWAY ENGINEERS

- FHWA , 1986 25+ 1
Agency - 6 Subject - 14 Newsletter - 0

FORT DUQUESNE BRIDGE: FRACTURE ANALYSIS OF FLANGE CORES

- FHWA , 1984 60 1
Agency - 12 Subject - 6 Newsletter - 9

FRONT END LOADERS 2-3 CYD ARTICULATING RUBBER TIRED 4-WHEEL DRIVE

- PURDUE UNIV , 1983 8 1
Agency - 8 Subject - 11 Newsletter - 0

FUNDAMENTALS OF TRAFFIC ENGINEERING 11TH EDITION

- UNIV OF CALIFORNIA , 1984 200+ 1
Agency - 19 Subject - 10 Newsletter - 0

FUNDAMENTALS OF TRAFFIC ENGINEERING
10TH EDITION

- UNIV OF CALIFORNIA , 1981 200+ 1
Agency - 19 Subject - 10 Newsletter - 0

GASAHOL FACTS ABOUT

- SOLAR ENERGY INF DATA BANK, 1977 5 1
Agency - 24 Subject - 21 Newsletter - 0

GEORGIA TRUCK WEIGHT LAWS AND TRAFFIC CONTROL WORKSHOP

- GDOT , 1984 15+ 1
Agency - 15 Subject - 28 Newsletter - 12

GOOD PRACTICES GUIDE FEDERAL AID
URBAN SYSTEM PROGRAM

- FHWA , 1985 22 1
Agency - 6 Subject - 28 Newsletter - 0

GROWTH MANAGEMENT AND TRANSPORTATION

- PUBLIC TECH INC. D.C., 1982 29+ 1
Agency - 24 Subject - 8 Newsletter - 0

GUIDELINES FOR DESIGN OF LOCAL ROADS
AND STREETS

- PENNDOT , 1983 65+ 1
Agency - 16 Subject - 22 Newsletter - 0

GUIDELINES FOR MAKING PEDESTRIAN CROSSING
STRUCTURES ACCESSIBLE

- FHWA , 1984 27 1
Agency - 6 Subject - 23 Newsletter - 0

GUIDE MANUAL RECORDS AND REPORTS
FOR INDIANA COUNTY HIGHWAY DEPARTMENTS

- PURDUE UNIV , 1981 186 1
Agency - 8 Subject - 8 Newsletter - 0

HANDBOOK OF COMPUTER MODELS FOR TRAFFIC
OPERATIONS ANALYSIS

- DIAZ SECKINGER & ASS. INC. TAMPA, 1982 285+ 1
Agency - 6 Subject - 10 Newsletter - 11

HANDBOOK ON DESIGN OF PILES AND DRILLED
SHAFTS UNDER LATERAL LOAD

- UNIV TEXAS , 1984 354+ 2
Agency - 6 Subject - 12 Newsletter - 0

HEX-FOAM G-R-E-A-T SYSTEM
DESIGN AND INSTALLATION MANUAL

- ENERGY ABSORPTION SYSTEMS INC., 1984 50 1
Agency - 23 Subject - 2 Newsletter - 0

HIGHWAY INFRASTRUCTURE: OPPORTUNITIES FOR INNOVATION

- ASCE , 1986 127 1
Agency - 30 Subject - 17 Newsletter - 0

HIGHWAY SAFETY OVERVIEWS

- OFF OF HW SAFETY , 1984 43+ 2
Agency - 6 Subject - 2 Newsletter - 0

HIGHWAY STATISTICS 1982

- HW STAT DIV , 1982 181 1
Agency - 6 Subject - 24 Newsletter - 0

HIGHWAY STATISTICS 1983

- HW STAT DIV , 1983 181 1
Agency - 6 Subject - 24 Newsletter - 0

HIGHWAY TAXES AND FEES HOW THEY ARE COLLECTED AND DISTRIBUTED

- FHWA , 1986 88 1
Agency - 6 Subject - 26 Newsletter - 0

HOT MIX BITUMINOUS PAVING MATERIAL

- FHWA , 1984 100+ 2
Agency - 6 Subject - 6 Newsletter - 0

HOT MIX RECYCLING

- KANSAS DOT , 1983 26 1
Agency - 12 Subject - 6 Newsletter - 0

HOUSING REPLACEMENT AT LAST RESORT

- OFF. OF ROW , 1975 22 1
Agency - 6 Subject - 22 Newsletter - 2

HOW TO SAVE LIVES AND REDUCE INJURIES
CITIZEN ACTIVIST GUIDE TO EFFECTIVELY FIGHT DRUNK DRIVING

- NHTSA , 1982 100+ 1
Agency - 2 Subject - 34 Newsletter - 0

HYDRAULIC DESIGN OF HIGHWAY CULVERTS

- FHWA , 1985 253 1
Agency - 6 Subject - 13 Newsletter - 0

HYDROLOGY

- FHWA , 1984 342 1
Agency - 31 Subject - 6 Newsletter - 8

ICE-MELTING CHARACTERISTICS OF CALCIUM MAGNESIUM ACETATE EXECUTIVE SUMMARY

- FHWA , 1986 10 1
Agency - 6 Subject - 27 Newsletter - 15

IDENTIFICATION ANALYSIS AND CORRECTION OF HIGH ACCIDENT LOCATIONS

- MIDWEST RESEARCH INSTITUTE , 1975 134+ 1
Agency - 6 Subject - 2 Newsletter - 0

IMPROVED BACKFILL STABILIZATION MATERIALS

- SW RESEARCH INSTITUTE , 1985 19 1
Agency - 29 Subject - 14 Newsletter - 0

IMPROVED FABRICATION AND INSPECTION OF WELDED CONNECTIONS IN BRIDGE STRUCTURES

- GARD INC., 1984 111 1
Agency - 12 Subject - 6 Newsletter - 8

IMPROVING GUARDRAIL INSTALLATIONS ON LOCAL ROADS AND STREETS

- FHWA , 1986 37 13
Agency - 6 Subject - 2 Newsletter - 14

IMPROVING SUBDRAINAGE AND SHOULDERS OF EXISTING PAVEMENTS

- UNIV ILLINOIS , 1982 212+ 2
Agency - 6 Subject - 13 Newsletter - 4

INFLATION-RESPONSIVE FINANCING FOR STREETS AND HIGHWAYS

- PUBLIC TECH INC. D. C., 1982 40+ 1
Agency - 17 Subject - 26 Newsletter - 0

INTERCEPTING DOWNTOWN-BOUND TRAFFIC

- US DOT , 1982 66 1
Agency - 24 Subject - 1 Newsletter - 0

INTERNATIONAL SLURRY SEAL ASSOCIATION
INTERNATIONAL DIRECTORY

- INT SLURRY SEAL ASSOCIATION , 1986 25 1
Agency - 41 Subject - 35 Newsletter - 15

INSPECTOR'S MANUAL FOR TRAFFIC SIGNAL CONSTRUCTION

- TEXAS DEPT OF HWAYS , 1985 1 42
Agency - 10 Subject - 15 Newsletter - 0

JUNKYARDS THE HIGHWAY AND
VISUAL QUALITY

- ORG FOR ENVIO GROWTH INC. WASH DC, 1979 129+ 1
Agency - 6 Subject - 27 Newsletter - 0

LOCAL FUNDING OPTIONS FOR WISCONSIN URBAN
TRANSITS SYSTEMS

- WIS DOT , 1982 82 1
Agency - 24 Subject - 2 Newsletter - 0

LONGITUDINAL EDGE DRAINS IN RIGID PAVEMENT SYSTEMS

- FHWA , 1986 129 1
Agency - 6 Subject - 13 Newsletter - 15

LOW-VOLUME ROADS: THIRD INTERNATIONAL
CONFERENCE 1983

- TRANS RES BD , 1983 378+ 2
Agency - 18 Subject - 24 Newsletter - 0

MAINTENANCE OF HIGHWAY SAFETY HARDWARE

- FHWA , 1983 2 4
Agency - 6 Subject - 19 Newsletter - 0

MAINTENANCE MANAGING THE MAITENANCE FUNCTION
PART C- PREVENTIVE MAINTENANCE

- PLANT ENG LIBRARY , 1981 33 2
Agency - 6 Subject - 19 Newsletter - 0

MAKING ENERGY REGULATIONS

- US DEPT OF ENERGY , 1979 21 1
Agency - 24 Subject - 21 Newsletter - 0

MANAGING HIGHWAY MAINTENANCE

- FHWA , 1985 20 1
Agency - 6 Subject - 28 Newsletter - 0

MANUAL OF GUIDANCE

- DOT , 1978 25 1
Agency - 15 Subject - 8 Newsletter - 0

MANUAL ON COUNTERMEASURES FOR SIGN VANDALISM

- FHWA , 1986 152 5
Agency - 6 Subject - 19 Newsletter - 16

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

- FHWA , 1986 150 1
Agency - 6 Subject - 28 Newsletter - 0

MASTERING TRAFFIC ENGINEERING

- MILITARY TRAFFIC MANAGEMENT COMMAND, 1981 64+ 2
Agency - 10 Subject - 20 Newsletter - 8

MICROCOMPUTER APPLICATIONS IN TRAFFIC ENGINEERING AGENCIES

- DIAZ SECKINGER & ASS. INC., 1983 50+ 1
Agency - 6 Subject - 10 Newsletter - 0

MICROSOFT FORTRAN COMPILER

- MICROSOFT CORPORATION , 1984 264 1
Agency - 30 Subject - 32 Newsletter - 0

MINOR MAINTENANCE MANUAL FOR COUNTY BRIDGES

- HERPICC , 1984 55 1
Agency - 12 Subject - 8 Newsletter - 0

MODEL COUNTY SUBDIVISION REGULATIONS

- PURDUE UNIV , 1983 55+ 2
Agency - 8 Subject - 28 Newsletter - 0

MOTORIST DIRECTION-FINDING AIDS RECOVERY FROM FREEWAY EXITING ERRORS

- TURNER-FAIRBANK HW RESEARCH CENTER, 1984 47 2
Agency - 6 Subject - 10 Newsletter - 10

MTPS MICROCOMPUTERS IN TRANSPORTATION

- US DOT , 1984 50+ 1
Agency - 24 Subject - 32 Newsletter - 0

MTPS MICROCOMPUTERS IN TRANSPORTATION
A REVIEW OF ACCOUNTING SOFTWARE FOR TRANSIT

- UMTA , 1986 79 1
Agency - 1 Subject - 32 Newsletter - 0

MULTIPROJECT PROGRAMMING AND SCHEDULING SYSTEM

- DOT , 1979 11 1
Agency - 15 Subject - 32 Newsletter - 0

NATIONAL EXPERIMENTAL AND EVALUATION PROGRAM
FINAL REPORT

- EXPERIMENT PROJECTS PROGRAM , 1984 19 1
Agency - 17 Subject - 6 Newsletter - 0

NATIONAL EXPERIMENTAL PROJECTS TABULATION

- FHWA , 1985 453 1
Agency - 6 Subject - 24 Newsletter - 0

NATIONAL EXPERIMENTAL PROJECTS TABULATION

- EXP APP AND EVAL , 1984 456 1
Agency - 6 Subject - 24 Newsletter - 0

NATIONAL EXPERIMENTAL PROJECTS TABULATION

- EXP APP AND EVAL , 1982 305 1
Agency - 6 Subject - 24 Newsletter - 0

NATIONAL URBAN MASS TRANSPORTATION STATISTICS

- TRANS SYS CENTER , 1983 34 1
Agency - 1 Subject - 24 Newsletter - 0

NATIONAL URBAN MASS TRANSPORTATION STATISTICS

- TRANS SYS CENTER , 1982 400+ 1
Agency - 1 Subject - 24 Newsletter - 0

NATIONAL URBAN MASS TRANSPORTATION STATISTICS

- TRANS SYS CENTER , 1983 500+ 1
Agency - 1 Subject - 24 Newsletter - 0

NATIONAL URBAN MASS TRANSPORTATION STATISTICS

- TRANS SYS CENTER , 1984 500+ 1
Agency - 1 Subject - 24 Newsletter - 0

NATIONAL WEIGH IN MOTION CONFERENCE

- COLORADO DOT , 1983 400+ 1
Agency - 4 Subject - 24 Newsletter - 0

NATIONWIDE STANDARDS RESEARCH PROJECT FOR
PUBLICLY OWNED ELEMENTARY AND HIGH SCHOOLS

- ORG. FOR ENVIRO. GROWTH INC. WASH DC, 1980 157+ 1
Agency - 6 Subject - 17 Newsletter - 0

NIGHT VISIBILITY OF OVERHEAD GUIDE SIGNS:
A REVIEW OF THE LITERATURE

- TURNER-FAIRBANK RESEARCH CENTER, 1984 91 2
Agency - 6 Subject - 10 Newsletter - 10

OFFICIAL CODE OF GEORGIA:ANNOTATED

- STATE OF GA , 19 75+ 1
Agency - 39 Subject - 28 Newsletter - 0

OPERATION AND PERFORMANCE CHARACTERISTICS
OF DRUM MIX PLANTS

- FHWA , 1984 83+ BOX
Agency - 6 Subject - 6 Newsletter - 9

OUR NATION'S HIGHWAYS

- FHWA , 1981 23 7
Agency - 6 Subject - 24 Newsletter - 0

OUTDOOR ADVERTISING CONTROL AND
ACQUISITION

- FHWA , 1981 23 1
Agency - 6 Subject - 27 Newsletter - 0

PARATRANSIT FOR THE WORK TRIP:
COMMUTER RIDESHARING

- MULTISYSTEMS INC. MASS, 1982 88 1
Agency - 24 Subject - 1 Newsletter - 0

PASS PRICING DEMONSTRATION IN CINCINNATI OHIO

- URBAN MASS TRANSPORTATION ADMINISTRATION , 1984 106+ 1
Agency - 1 Subject - 1 Newsletter - 0

PATCHING FLEXIBLE AND RIGID PAVEMENTS

- NY DOT , 1979 20 1
Agency - 6 Subject - 6 Newsletter - 0

PAVEMENT AND SHOULDER MAINTENANCE
PERFORMANCE GUIDES

- FHWA , 1984 40 1
Agency - 6 Subject - 6 Newsletter - 8

PAVEMENT CONDITION SURVEY AND RATING PROCEDURES

- APWA , 19 100 1
Agency - 31 Subject - 6 Newsletter - 0

PAVEMENT CUTS FOR UTILITIES:
A GUIDE FOR THEIR MANAGEMENT

- HERPICC , 1984 25 1
Agency - 6 Subject - 8 Newsletter - 0

PAVEMENT MAINTENANCE MANAGEMENT SYSTEMS

- APWA , 1985 20 1
Agency - 31 Subject - 19 Newsletter - 0

PAVEMENT MAINTENANCE AND REHABILITATION:
TECHNIQUES USING ASPHALT

- UNIV CAL , 1984 88 1
Agency - 6 Subject - 6 Newsletter - 0

PAVEMENT MANAGEMENT AND REHABILITATION OF
PORTLAND CEMENT CONCRETE PAVEMENTS

- TRANS RES BD , 1981 70 1
Agency - 18 Subject - 6 Newsletter - 0

PAVEMENT MANAGEMENT REHABILITATION PROGRAMMING:
EIGHT STATES' EXPERIENCES

- FHWA , 1983 76+ 1
Agency - 6 Subject - 6 Newsletter - 0

PAVEMENT PATCHING GUIDELINES

- RESOURCE INTER INC. OHIO, 1983 72 2
Agency - 6 Subject - 6 Newsletter - 0

PAYING FOR TRANSPORTATION AT THE LOCAL LEVEL: 17 STRATEGIES

- APWA , 1984 24 1
Agency - 31 Subject - 26 Newsletter - 0

PHASE II-FINAL REPORT;MANUAL FOR SMALL TOWNS AND RURAL AREAS TO DEVELOP A HAZARDOUS
MATERIALS EMERGENCY PLAN

- USDOT , 1986 130 1
Agency - 24 Subject - 3 Newsletter - 0

PHASE III FINAL REPORT
RISK ASSESSMENT

VULNERABILITY VALIDATION STUDY VOL.2 APPENDICES:11 INDIVIDUAL STUDIES

- US DOT , 1983 290 1
Agency - 24 Subject - 3 Newsletter - 0

PHOENIX TRANSIT SUNDAY DAIL-A-RIDE

- CRAIN & ASS. INC. CALF, 1983 28+ 1
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AS A HIGHWAY DISPLACEE

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VIDEO TAPE LIST

VIDEO TAPES NOW AVAILABLE FROM THE TECHNOLOGY TRANSFER CENTER

The Technology Transfer Center is beginning a video tape library. The VHS tapes listed below may be borrowed, at no charge, for a **two week** period. Please phone or write and request no more than two tapes at a time. Specify the tapes you want by the number in the left hand column.

SAFETY AND TRAFFIC

- ST-201 The Winners--The Losers (13 minutes)**
Safe use of lift trucks including inspection and hazards facing operators.
- ST-205 Traffic Control and Tort Liability (50 minutes)**
Gives suggestions concerning traffic control devices for local jurisdictions to help avoid tort liability suits.
Tort Liability (60 minutes)
Discusses tort liability and local jurisdiction responsibility with respect to design and operation of transportation facilities.
- ST-212 Night Safety at Worksites (12 minutes)**
Specifications for providing a safe nighttime environment in construction zones.
Work Area Flagging (25 minutes)
When and where to use flagging, responsibilities and requirements of flaggers, and proper flagging procedures.
Selection and Use of Traffic Control Devices (30 minutes)
Objectives of work area traffic control, selection of proper control devices.
- ST-213 Introduction to Work Area Traffic Control (30 minutes)**
Basic principles of work area traffic control and inputs into selecting proper traffic control.
Partners in Safety (15 minutes)
Describes work area traffic control and how to use it properly to achieve cooperation between the road user, contractor and flagger.
Sample Applications of Work Area Traffic Control (30 minutes)
Devices used as work area traffic control for both mobile or short and long term construction zones.
Speed Zoning by Montana Highway Patrol (30 minutes)
Describes background and misconceptions of speed zoning and the procedures for determining speeds of highways and local roads.

MAINTENANCE

- M-201 The Snowfighters (24 minutes)**
Methods, procedures, and equipment for snow removal on streets and highways.

- M-202 Down is Up (20 minutes)**
Preventive maintenance is stressed to reduce down time on construction sites.
- M-203 The Choice is Yours (18 minutes)**
Preventive maintenance on diesel engines is stressed to get maximum life from the engine.
- M-204 Signals: Read 'Em or Weep (20 minutes)**
Indications of problems with equipment.
- M-205 Upgrading Gravel Roads (20 minutes)**
Discusses how gravel and asphalt roads can be recycled using low cost alternatives.
Rural Roads, A New Approach (27 minutes)
Discusses gravel road problems and solutions to these problems including the use of filter fabrics on gravel roads and strengthening old bridges to handle modern loads.
- M-206 Introduction to Bridge Inspection (25 minutes)**
Prepared for agencies that are required to inspect bridges in their jurisdiction. Covers federal requirements, reference materials, condition inspection and rating, structural inventory, and safety considerations..
Pre-Stressed Concrete Bridge Inspection (50 minutes)
Describes pre-stressed concrete bridges, inspection sequence, and how to prepare for an on-site inspection.
Inspection of Pin and Link Details on Bridge Structures (32 minutes)
Discusses pin and link details and inspection procedures.
- M-207 Steel Truss Bridge Inspection (50 minutes)**
Discusses inspection of small truss bridges including equipment, reporting forms, and what to look for.
Timber Bridge Inspection (50 minutes)
Describes common problems with timber bridges and demonstrates how the inspection is conducted.
- M-208 Roadway Maintenance Cost Analysis--Part I (50 minutes)**
Discusses equipment costs including depreciation, fuel, oil, grease, maintenance, repair, and capital investment.
Roadway Maintenance Cost Analysis--Part II (50 minutes)
Discusses maintenance operating costs relating to labor, equipment, materials, and overhead.
- M-209 Roadway Maintenance Cost Analysis--Part III (50 minutes)**
Discusses the cost of deferred maintenance.
Roadway Maintenance Cost Analysis--Part IV (50 minutes)
Gives ideas on how to present budget data to county commissioners and city councils.

- M-210 Maintenance of Highway Safety Hardware (45 minutes)**
How to provide safe roadside environments through periodic maintenance of the road side and its safety hardware.
- M-211 Maintaining Granular Surfaced Roads (18 minutes)**
Instructional guide to enable road grader operators to provide better maintenance of granular surfaced roads.
Snow Removal on Iowa's Secondary Roads (20 minutes)
Instructional guide for snowplow operators for winter road maintenance of secondary roads.
- M-212 Ditchmaster (10 minutes)**
Demonstration of the ditchmaster, a cost effective machine for improving roadside drainage and maintenance.
Lee-Boy Asphalt Maintainer (15 minutes)
Demonstration of the Lee-Boy, an asphalt and maintenance machine.
Rosco Asphalite Maintainer (15 minutes)
Demonstration of a pot hole repair machine.
- M-213 Techniques for Pavement Maintenance and Rehabilitation Using Asphalt--Part I**
Introduction (15 minutes)
Introduction to a series of tapes dealing with using asphalt for pavement maintenance and rehabilitation.
Asphalt Components, Materials, Tests, and Basics of Design (40 minutes)
Discusses the components of an asphalt paving structure from subgrade to the asphalt top.
- M-214 Techniques for Pavement Maintenance and Rehabilitation Using Asphalt--Part II**
Pavement Deterioration Ratings (30 minutes)
Discusses graphs involving pavement deterioration, cost of rehabilitation, pavement life and rating of pavement deterioration.
Types of Patching and Crack Sealing (52 minutes)
Examples of pavement deterioration and discusses methods of patching, crack sealing and equipment used.
- M-215 Techniques for Pavement Maintenance and Rehabilitation Using Asphalt--Part III**
Sealing of Joints in Portland Cement Concrete (25 minutes)
Discusses cleaning and sealing of joints in Portland cement concrete roadways.
Surface Treatment of Pavement (54 minutes)
Discusses objectives and methods of applying seal coats, spraying of liquid asphalt, surface condition variables, spraying oil onto pavement and spreading aggregate.
- M-216 Techniques for Pavement Maintenance and Rehabilitation Using Asphalt--Part IV**
Cost Analysis (20 minutes)
Discusses methods and strategies for determining which method of maintenance is needed. Cost analysis is emphasized.

Recycling Procedures (35 minutes)

Describes recycling procedures with asphalt and shows some of the equipment used.

DESIGN AND CONSTRUCTION

DC-201

800 Miles of Winter (28 minutes)

Construction of the Trans-Alaskan pipeline.

Men Against Rock (30 minutes)

Discussion of construction in rocky areas on a variety of projects including drilling, blasting, earth moving and tunneling.

Why Handle It Twice? (16 minutes)

Construction and reclamation of an open-pit coal mine using scrapers.

The New Shape of Value (14 minutes)

Demonstrates the capabilities of the Caterpillar D-10 unit including ripping, push loading of scrapers and dozing.

Versatility with a Boom (10 minutes)

Shows multiple uses of hydraulic excavators.

DC-202

The Roll of Drums (18 minutes)

Discusses taking unnecessary chances on construction work sites.

Shake Hands with Danger (23 minutes)

Safety procedures for operating and maintaining earth moving machines.

Making the Most with Scrapers (23 minutes)

The productive use of scrapers.

Operating Tips: Elevating Scrapers (11 minutes)

Discusses inspection, start-up procedures and work alone features such as cutting and loading material.

Operating Tips: Wheel-Tractor Scrapers (18 minutes)

Discusses inspection, start-up procedure, and operating techniques.

DC-203

Operating Tips: Push-Pull Scrapers (12 minutes)

Discusses cut and fill operations for pairs of scrapers.

Operating Tips: Off-Highway Trucks (17 minutes)

Discusses inspection, start-up procedure and off-road operations.

Operating Tips: Track-Type Tractors (15 minutes)

Considerations for safe and efficient operation including inspection, dozing, land clearing, ripping and push loading scrapers.

Loading Logic (17 minutes)

Efficient choice and use of loaders and trucks for hauling soil.

Operating Tips: Wheel-Tractor Scrapers (18 minutes)

Discusses inspection, start-up procedure and operating techniques.

Operating Tips: Track-Type Loaders (10 minutes)

Discusses inspection, start-up procedure and excavation for a variety of cases.

Operating Tips: Wheel Loaders (10 minutes)

Discusses inspection, start-up procedure and operation.

DC-204

Tied Concrete Shoulder (10 minutes)

Shows construction of tied concrete shoulders, undersealing of

existing pavement and full-depth repair of the pavement.

Recycling D-Cracked Concrete Pavement (12 minutes)

Discusses the reasons for the use of concrete recycling over conventional methods of construction.

Bonded Concrete Overlay (12 minutes)

Shows a bonded concrete overlay on existing concrete pavement.

DC-205 Interstate Reconstruction--Part I (12 minutes)

Recycling existing D-Cracked pavement as aggregate for new concrete pavement.

Whitetopping (7 minutes)

Discusses placing a concrete overlay on distressed asphalt concrete.

Design for Quality (12 minutes)

Shows recycling of concrete pavement and replacement with continuously reinforced concrete pavement, bonded concrete overlay and tied concrete shoulders.

DC-206 Interstate Reconstruction--Part II (13 minutes)

Shows add-on tied concrete shoulders, diamond grinding for smoothness, and establishing new transverse joints.

Recycling Continuously Reinforced Concrete Pavement (10 minutes)

Shows the recycling of existing continuously reinforced concrete pavement as aggregate for new concrete pavement.

Unbonded Concrete Overlay (12 minutes)

Construction of a full-depth unbonded overlay over a reinforced concrete pavement.

DC-207 Testing of Asphalt Cement (24 minutes)

Procedures for various tests of asphalt cement including flashpoint, penetration, ductility solubility, spot softening point, specific gravity and thin film over tests.

Determination of Asphalt Content in Paving Mixtures (20 minutes)

Procedures for determining asphalt content for proper life and serviceability of asphalt cement.

Budgeting for Rehabilitation (25 minutes)

Presents economic situation of restoring paved highways and evaluation of pavements for determination of priority for restoration.

Asphalt Emulsion Spray Applications (20 minutes)

Reasons for using asphalt emulsions, what constitutes asphalt emulsions, how they work, and processes for applying asphalt emulsions.

Aggregate Blends (40 minutes)

Demonstrates graphical procedure for blending aggregate sources to meet proper specifications.

DC-208 AASHO Road Test

Construction and Materials (27 minutes)

Discusses materials and construction of extensive test facilities constructed in 1956 by AASHO to test different types of road surfacings, bases, bridges and methods of construction.

Pavement Research (37 minutes)

Objectives, methods, and principle results of pavement research in

the AASHO Road Test.

The Road to Better Roads (14 minutes)

Summarizes the purposes and procedures of the AASHO Road Test and discusses what is being done today to improve roads.

DC-209 Verglimit--Mixing and Laying (10 minutes)

Proper procedures for handling, storing, mixing and laying verglimit asphalt cement, ice and snow retarders.

DC-210 I-90 The Final Link (20 minutes)

The completion of I-90 near Seattle; its design and construction problems.

Basics of the Local Road Engineer (50 minutes)

The basic components of road engineering are covered, emphasis on traffic safety.

DC-211 Energy Conservation in Community Water Systems (25 minutes)

Conservation methods used in water systems to help reduce operating expenses and operating budgets.

The Importance of Road Drainage (40 minutes)

Describes how to make an inventory of drainage structures for easier maintenance by mapping these structure and problem flood areas; fundamentals of design and sizing of culverts and ditches.

DC-212 Stabilization for Low-Volume Roads (10 minutes)

Describes adding soil stabilizing agents to low volume roads to increase drainage capabilities, base stabilization and reduce maintenance costs.

Oklahoma Slide Show on Geotextiles (25 minutes)

Experiments using geotextiles cloth overlayed with gravel in roadways during wet conditions.

Stabilization, Holding the Road (20 minutes)

Demonstrates the process of building a stabilized road and shows the advantages of stabilized roads over surface treated roads.

Lime: The Versatile Soil Stabilizer (25 minutes)

Use of lime in road stabilization, its history, advantages, uses, process for making lime, and how to use lime in the construction process.

DC-213 Standard Soil Tests (40 minutes)

Describes several standard AASHTO soils tests.

Concrete Field Testing and Sampling (25 minutes)

Complete process for the concrete field tester. Shows tests for slump, air content, unit weight, chase indicator, kellyball and preparation of concrete cylinders for strength tests.

AASHTO T-99 (12 minutes)

Determines the moisture-density relationship of soils.

AASHTO-27 (20 minutes)

Sieve analysis for both fine and coarse aggregates.

DC-214 Design of Urban Streets--Part I

Conceptual Approach to Urban Street Design (25 minutes)

Introduction to series of tapes on urban street design.

Capacity (30 minutes)

Describes concepts of road capacity and level of service, peak hour factor, load factor as references from the highway manual.

Techniques for Maximizing Capacity to Traffic Studies (30 minutes)

Describes techniques for maximizing capacity on roads and at intersections.

Street Design Elements--Part I (30 minutes)

Discusses location design of urban streets and coordination of facilities. Also includes discussion of metric units in design.

DC-215

Design of Urban Streets--Part II

Street Design Elements - Part 2 (30 minutes)

Describes cross-sectional design and horizontal alignment design.

Street Design Elements - Part 3 (30 minutes)

Describes vertical alignment design, design of vertical curves, drainage design and design for access control.

Intersection Design Elements (30 minutes)

Describes the basic intersection types, types of channelization, corner design pedestrian movement, vehicular movement and turning movements.

Intersection Design Elements (Continued) (30 minutes)

Describes intersection control, problem identification and improvement techniques for problem areas. It also describes some type of urban and freeway techniques.

DC-216

Design of Urban Streets - Part III

Traffic Signal Design and Operation (30 minutes)

Basic principles of signals, advantages, disadvantages, the various types of signals and operations of different traffic signals.

Illumination, Signs and Markings (30 minutes)

Advantages of lighting arterial streets, types of lights and elements considered in designing lighting systems, importance of signs and markings in street design and uniformity of signs and markings.

Pedestrians, Bicycles and Transit Considerations (30 minutes)

Discusses the integration and design of pedestrian, bicycle and transit facilities into the urban street plan.

Factors Impacting Street Design (30 minutes)

Special factors which affect the design of urban streets.

DC-217

Design of Urban Streets - Part IV

Social and Economic Impacts (30 minutes)

Social and economic impacts by the upgrading or design of new urban roadway facilities.

Environmental Consideration (30 minutes)

Environmental impact caused by urban street design. Emphasis on air and noise pollution.

Project Documentation (30 minutes)

Evaluation techniques for comparing design alternatives and selections.

Administration and Management (30 minutes)

Consultant selections, bid procedures, contractor prequalifications, supervision of work and legal aspects of the design and designer.

DC-218

Asphalt Paving Inspection (28 minutes)

Discusses sampling of aggregate, storage, cold feed, mixing plant and plant inspection.

Pothole Repair (12 minutes)

Demonstrates traffic control during repair, marking, cleaning, filling and cleanup.

COMPLETE AND RETURN TO:

**John Moskaluk
Technology Transfer Center
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**ROADWAY MAINTENANCE
WORKSHOPS SUMMARIES**

ROADWAY MAINTENANCE WORKSHOP
MAY - JUNE, 1986
STATEWIDE SUMMARY

<u>WORKSHOP LOCATION</u>	<u>PEOPLE ATTENDING</u>	<u>COUNTIES REPRESENTED</u>	<u>CITIES REPRESENTED</u>
Gainesville May 20-22	54	9	10
Tennille May 6-8	45	9	13
Thomaston May 13-15	50	10	17
Tifton April 29-May 1	50	11	14
Jesup April 22-24	55	9	16
Cartersville May 27-29	13	4	3
Atlanta June 3-5	65	5	14
	<u>332</u>	<u>57</u>	<u>87</u>

- percent of state's 159 counties represented: 35.85
- average workshop: 47.4 persons, 8.1 counties, 12.4 cities
- comparison to 1983/1984 Roadway Maintenance Workshop:
 - 10.3% more persons (332 vs. 301)
 - 12.3% fewer counties (57 vs. 65)
 - 52.6% more cities (87 vs. 57)

ROADWAY MAINTENANCE WORKSHOP
JANUARY - FEBRUARY, 1988
SUMMARY

WORKSHOP LOCATION	TOTAL ATTENDANCE	DOT ATTENDANCE	COUNTIES REPRESENTED	CITIES REPRESENTED	PERSONS PAID
Chamblee January 19-20	44	13	6	7	27
Thomaston January 21-22	37	0	4	4	34
Gainesville January 26-27	43	0	8	9	27
Cartersville January 28-29	46	37	7	1	15
Jesup February 3-4	47	0	8	17	18
Tifton February 10-11	32	0	9	7	10
Tennille February 17-18	36	5	9	9	30
TOTALS	285	55	51	54	161

Percent of State's 159 counties represented: 32%
 Percent of those attending who were GDOT personnel: 35%
 Percent of those attending who paid the registration fee: 56%
 Average workshop attendance: 40.7

Comparison to 1986 Roadway Maintenance Workshop:
 14.2% fewer persons (285 vs. 332)
 10.5% fewer counties (51 vs. 57)
 37.9% fewer cities (54 vs. 87)

NEWSLETTERS



TECH TRANS



SCHOOL OF CIVIL ENGINEERING
GEORGIA INSTITUTE OF TECHNOLOGY
UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA

TECHNOLOGY TRANSFER CENTER

VOL. 5 NO. 1

WINTER 1987

GEOTEXTILES—They can be cost effective!

A geotextile is any permeable textile material used with foundation, soil, rock, earth or any other geotechnical engineering or related material, as an integral part of a man-made project, structure, or system. Geotextile generally refers to knitted, woven, and nonwoven fabrics.

Geotextile use covers primarily four areas, i.e., separation (protection of granular material from clay intrusion or contamination, filtration and drainage (filtered groundwater entering an under-drain system causing subsequent contamination and plugging), erosion control (helps prevent loss of fine material into adjacent streams, ponds, etc.), and reinforcement fabric reinforced for earth retaining walls.

For thousands of years non-soil materials have been used together with soil to improve certain desirable properties or to correct some undesirable properties of soil materials. Some of the examples in the natural world are nests of insects, birds, and beaver dams. Man-made examples include adobe bricks and corduroy roads.

Table 1 shows where the geotextile fabric was used in 1982 with an estimated value of business in the United States of more than \$100 million per year.

There are a number of processes involved in the manufacture of geotextiles. Geotextiles and geotextile related products are usually made from synthetic polymers, i.e., polypropylene, polyester, polyethylene, polyamide, and nylon. These man-made polymers are highly inert to biological and chemical degradation.

Natural fibers (wool, cotton, etc.) are seldom used in geotextiles because they are biodegradable and will rot when in contact with soil.

There are ten types of geotextiles and geotextile related products that are commonly recognized based on their manufacturing process. They are listed as follows: knitted, woven, nonwoven and composite geotextiles. Geotextile related products include webs or webbings, mats, nets, grids, formed plastic sheets, and prefabricated composite structures.

TABLE 1 — GEOTEXTILE FABRIC BY END-USE-1982

Squares Yard (in millions)	
Primary Roads (New and Repaving)	33.6
Stabilization	28.8
Secondary and Access Roads	16.8
Drainage	13.6
Erosion Control	12.0
Other	7.2
Railroads	6.2
TOTAL	120.0



(From Geotechnical Fabrics Report, Vol. No. 1, 1983, p 28)

Continued on page 3

MAINTENANCE TIPS

DEEP PATCHING WITH PREMIX

Asphalt cracks occur for different reasons and in different forms. The maintenance of each crack depends on the crack type and cause of occurrence. Deep patching with premix is used to repair alligator and slippage cracks and severe potholes.

Alligator cracks are numerous and short in length, forming small blocks which resemble the skin of an alligator. They are caused by a relatively stiff pavement which is deflected excessively. The most common cause of this failure is a spongy subgrade of unstable base material resulting from saturation of the base. Initially, alligator cracking is not critical, but it will deteriorate rapidly under traffic into other types of deficiencies such as potholes.

Slippage cracks are crescent (half-moon) cracks in the direction of traffic flow with the two ends pointing away from the direction of flow. They are caused by the asphalt concrete surfacing sliding on the underlying surface due to the lack of a tack coat. They may also occur when the pavement is deflected excessively due to the braking of heavy vehicles. For failures resulting from lack of bond, the correct repair method is spot patching with premix. When failure is caused by excessive deflection, deep patching with premix is a good solution.

Crew required:

- Equipment operators	2
- Truck drivers	2
- Laborer	1
- Flagmen	2

Equipment required:

- Dump trucks	2
- Portable roller	1
- Motor grader	1
- Asphalt kettle	1
- Grapple or front end loader	1
- Concrete saw or air compressor	1

Material required:

- Hot premix asphalt concrete
- Liquid asphalt tack coat
- Base material (if required)
- Underdrain pipe (if required)

Repair procedure:

1. Place signs and other safety devices.
2. Break out and remove old pavement. Cut vertical edges 6 inches outside the distressed area on all sides. Make cuts square with roadway centerline.
3. Install underdrains if required.
4. Recompact base material and replace unsuitable material.
5. Apply light even tack coat of heated asphalt to the vertical sides of the area.
6. Place hot premix into area using a motor grader or by hand and spread material in layers not exceeding 3 inches. Roll each layer before applying another layer.
7. Compact the surface with a portable roller.
8. Check the surface with a straight edge to assure it is level and flush with the adjacent surface.

Continued on page 9

B.C.



By Johnny Hart



The uses mentioned above have all proven satisfactory time and time again; however, use of geotextiles in pavements to prevent reflection cracking have not been proven as a cost effective method. You might say that its use in pavements is in somewhat of an experimental stage. Geotextiles can be a cost effective way of solving a problem condition and/or selection of an alternative and satisfactory method.

It is important that the correct geotextile for a specific condition be selected. This is not easy to do for the inexperienced person as noted in the above discussion. Also, proper installation is very important. It is suggested that guidelines be developed by experienced users and manufacturers of geotextiles.

The Wheel, Colorado State University, Fall, 1986.

ACKNOWLEDGEMENT

The Technology Transfer (T2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual State Departments of Transportation. Its purpose is to translate into understandable terms the latest state-of-the-art technologies in the areas of roads, bridges, and public transportation, to local and county highway and transportation personnel.

The T2 Center at Georgia Tech is sponsored by the Georgia Department of Transportation and provides information and counsel to more than 500 municipalities and counties in our state. This newsletter is designed to keep you informed about new publications, new techniques, and new training opportunities that may be helpful to you and your community. Individuals wishing to receive future copies of this newsletter at no cost may send their requests to:

M. John Moskaluk
Technology Transfer Center
School of Civil Engineering
Georgia Tech
Atlanta, GA 30332



As you may have noticed in the Fall issue of TechTrans, we have changed editors. The new editor wants to clean house, and you can help. Please write or call and request the publications which we advertise as available from the Center. They are free, and they are for you. (I do not need two hundred copies of Improving Guardrail Installations on Local Roads and Streets.)

You will see in this issue that we finally have video tapes. This is completely new for us, and we are very excited about building our video tape library. These tapes may be checked out from the Center for a two week period. At this time, we have seventeen different tapes available. Some tapes contain more than one presentation. We will be getting additional tapes and will let you know what they are. Again, they are free, and they are for you. Please make use of this service.

The Technology Transfer Center still has data collection equipment which we will loan to you. We will be more than happy to show you how to use the equipment and to help you analyze your data. There is frequently a short waiting list for the use of the data collection equipment, so call right away and let us know when you will be needing it.

The Technology Transfer Center is here to serve you, but you must let us know what you need. Give us your input on what subjects you are interested in--for publications, tapes, and workshops. We are here to assist our friends in Georgia. Let us know your needs.

NEWS BRIEFS

- o The Colorado Department of Transportation has prepared an interim report which describes the installation and evaluation of 13 different bridge joint systems installed between 1978 and 1982. The report concludes that proper installation of the joint during construction is the most important factor affecting the success of an expansion joint. Additionally, recessing the joint 1/8 inch to 1/4 inch below the pavement profile significantly reduces damage by traffic and snow removal equipment.

- o The French colony of Saint-Pierre-et-Miquelon, located some 20 kilometers off the southern coast of Newfoundland, is said to have the second highest concentration of automobiles in the world, after the South Pacific island of Norfolk. The total number of cars has been estimated at more than 3500, although there are only 37 kilometers of roads to serve the island's 6000 residents. Observed one native "Driving is our illusion of escape."

- o Motorists will be paying an average of \$0.22 in state and federal taxes for every gallon of gasoline purchased, according to a new motor fuel tax survey the Highway Users Federation. State gasoline taxes average \$0.13 per gallon and the federal tax is a additional \$0.09 per gallon.

The Bureau of Labor Statistics reports that the average nationwide pump price was 89.5 cents-per-gallon in July, down from 95.8 cents in June. That figure includes all taxes.

All federal taxes on motor fuel go into the Federal Highway Trust Fund, which finances the Federal-aid Highway Program, including Interstates and other major roads and bridges. But unless Congress passes needed legislation, money from the 9 cents-per-gallon federal gasoline tax will stop flowing back to the states.

- o The state of Oklahoma loses \$11,000,000 in tax revenues every time the price of a barrel of oil drops by \$1.00.

- o The Navy's Civil Engineering Laboratory has developed the following guidelines for removing graffiti. For crayon, china markers, and ink products, scrub with a stiff bristle brush in a warm solution of trisodium phosphate (2 oz./gallon) and water. Allow one to two minutes of solvent action and then rinse with water. To remove painted markings from unpainted surfaces, scrub with a stiff bristle brush in methylene chloride or similar commercial remover. For removal of painted markings from painted surfaces, cautiously test one of three solvent mixtures--methyl ethyl ketone, xylene, or an equal volume of the two--to determine which is the most effective.

- o Traffic citations issued by a governmental entity may be challenged, and you may very well lose your case. Some recent citations issued pursuant to traffic control devices (signs, signals, and markings) violations have been challenged. In some instances, governmental entities have lost their cases since the devices did not comply with the Manual of Uniform Traffic Control Devices (MUTCD) as required by state statutes.

- o In the mineral industry, the front end loader leads all other equipment in fatalities. Most fatalities occur when the unloaded equipment is being driven from one worksite to another and most accidents occur when backing up.

- o The Texas Transportation Institute Proving Grounds have verified that truck tires do hydroplane. At inflation pressures of 75 psi, truck tires in the hydroplane test trough began hydroplaning at near legal highway speeds.

- o Results of a study performed by the Arizona Department of Transportation indicate that the standard issue surface thermometers do not provide accurate indications of the actual surface temperature. Text results suggest that temperature variations of 15-20° F can be expected between shade and sunlight aided readings and that electronic handheld temperature probes are more accurate and reliable.

TRAFFIC ACCIDENTS ON AND NEAR NARROW BRIDGES

Better land use control around bridge sites may be an effective accident countermeasure. This is one of several conclusions resulting from a study of data on 11,880 bridges and 24,809 accidents that occurred on these bridges or within their approach areas (1). The authors, Charles K. Brinkman of the Federal Highway Administration, and King K. Mak of Texas Transportation Institute, used computerized bridge and roadway inventory data files from the states of Arizona, Michigan, Montana, Texas and Washington covering a 3-year period, as the basis of a comprehensive statistical analysis to determine the relationship, if any, of accident frequency, rate, and severity to traffic and bridge and approach characteristics. For the study, a bridge was considered "narrow" according to the following definition:

- o One lane, a total width of 18 feet or less
- o Two lanes, a combined total width of 24 feet or less
- o Total approach roadway width greater than total bridge width. These bridges were further categorized based on whether the bridge shoulder width was less than 50 percent of the approach shoulder width.

STUDY CRITERIA

Only bridges on state highway systems were studied. Ninety percent of the study bridges were in rural areas and about 80 percent were two-lane, single structures on rural arterials and collectors. About 12 percent of the study bridges were two-lane twin structures--most of these being on interstate highways.

The authors emphasize that "the study findings apply only to bridges meeting the study criteria and should not be extrapolated to bridges not meeting these criteria." In addition to the requirement of being on the state highway system, the criteria for inclusion in the study were:

Bridges had to be overpass structures (excluding culverts) carrying mainline vehicular traffic. For twin structures filed as two separate bridges, only the first was selected for analysis.

- o No traffic control signals could be on the bridges or within the approach areas to the bridges
- o All key data elements on the bridges had to be known.

About 72 percent of the single structures were found to fit the definition of "narrow." These narrow bridges were more prevalent in rural areas and on the lower functional classes. The old design practice of aligning the approach roadway to accommodate the bridge alignment resulted in most of the studied bridges being straight and level.

Table 1.—Accident frequencies and rates by functional classification

Functional classification	Accidents per year per bridge ^a	Accidents per million vehicles
Urban:		
Interstate	5.04	0.517
Major arterial	2.66	0.636
Minor arterial	1.58	0.852
Collector	0.78	0.479
Average (weighted)	3.08	0.649
Rural:		
Interstate	1.09	0.456
Major arterial	0.71	0.634
Minor arterial	0.51	0.762
Collector	0.39	0.812
Average (weighted)	0.44	0.738

^aAccident rates were computed on the basis of the bridge length plus 500 ft (152.4 m) in each direction.

Table 2.—Distribution of accident severity

Functional classification	Percent incapacitating and fatal injury
Urban:	
Interstate	5.6
Major arterial	5.9
Minor arterial	6.5
Collector	1.7
Average (weighted)	5.8
Rural:	
Interstate	10.3
Major arterial	12.2
Minor arterial	9.5
Collector	12.9
Average (weighted)	11.4
Lane stratification	Percent incapacitating and fatal injury
One-lane:	5.9
Single structure, undivided	
Two-lane	11.4
Four-lane	5.6
Single structure, divided	
Four-lane	6.1
Other	3.5
Twin structure:	
Two-lane	8.7
Other	5.7
Overall average (weighted)	8.9

Continued on page 6

RURAL RATES HIGH

As shown in Table 1, accident frequencies (accidents per year per bridge) were higher on urban bridges than on rural bridges. However, this result is due to the higher traffic volumes on urban bridges and thus the overall accident rate (accidents per million vehicles) was higher on rural bridges. Accident rates also increased with lower functional class.

Table 2 shows accident severity (defined as percent incapacitating and fatal injuries) according to functional classification and lane stratification. As may be seen, accident severity was significantly higher (11.4 vs 5.8 percent) on rural bridges than on urban bridges; the authors observe that this is "possibly because single-vehicle accidents were more frequently (51.9 percent) on rural bridges while multi-vehicle accidents were predominant on urban bridges." They also note that additional factors such as higher speeds on rural highways may contribute to this difference in severity.

IMPACTS INVOLVING PARAPET ENDS SEVERE

For single-vehicle accidents, it was found that impacts involving parapet ends resulted in incapacitating and fatal injuries in 30 percent of the reported accidents compared to only 9.5 percent and 12 percent for guardrail and bridge rail collisions, respectively.

EFFECT OF BRIDGE NARROWNESS

Table 3 summarizes the effect of bridge narrowness on safety. The authors caution that the higher mean accident rate for one-lane bridges wider than 18 feet than for bridges less than 18 feet in width "was not statistically significant and the sample size was too small for reliable results."

As seen in Figure 1, for two-lane undivided single structures, the mean accident rates generally decreased with increasing bridge width if the width of the bridge was less than that of the approach roadway. Perhaps surprisingly, for those bridges that were wider than the approach roadway, the mean accident rate was not highest for the narrowest bridges but for those having widths between 20 and 22 feet.

Note also that the mean accident rates for bridges narrower than the approach width were significantly higher than for bridges wider than the width of the approach up to bridge width of 20 feet. No significant difference was found for widths greater than 20 feet.

EFFECT OF PHYSICAL AND OPERATIONAL FACTORS

Based on their statistical analysis of the data, the authors list, in order of importance, the physical and operational factors that distinguish "bridges with accidents" from "bridges with no accidents":

- o Average daily traffic
- o Roadside distraction
- o Percent shoulder reduction
- o Degree of bridge curvature
- o Curb presence
- o Bridge length
- o Approach curvature
- o Delineation

The authors are careful to note, however, that these variables "are not necessarily causal factors."

The study findings also "indicated that accident severity on bridges is little affected by the physical and operational characteristics at the bridge sites."

As helpful as accident studies may be, they are limited by a number of factors such as inaccurate accident locations and the large sample sizes necessary. Thus, the authors observe, "safety design decisions also must be based on the pure physics of the problem, traffic operational measures of effectiveness, and human factors research."

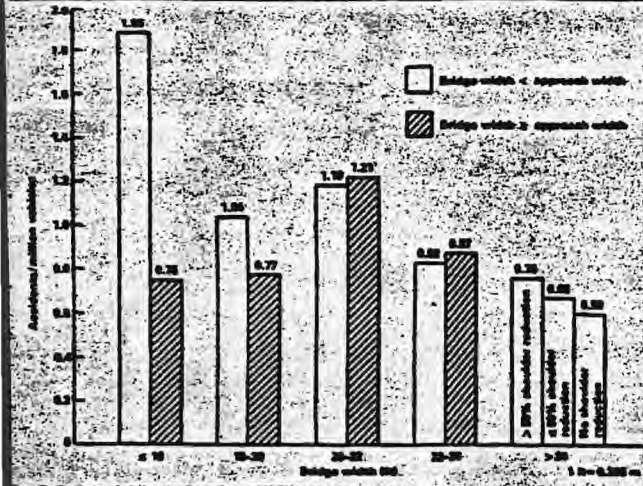
In-depth study of 124 single-vehicle bridge accidents in which the first impact was with a bridge rail, bridge parapet end, or approach guardrail, revealed that one-quarter of the vehicles were yawing at greater than 30 degrees at impact. Since yawing could increase the severity of impacts with bridge rail or parapet and guardrail ends, the authors suggest that yawing "possibly should be a parameter in the design of barrier systems."

The overall conclusion of the report is that "Bridges are more dangerous than the highway system as a whole, and narrow

Table 3. Accident rates by bridge width and approach width						
Bridge structure	Number of lanes	Bridge width (ft)		Accident rates per year per bridge		
		Shoulder reduction		Accident rates per million vehicles		
Unimproved	1	≤ 16		0.12		
		> 16		1.177		
	2	≤ 16, < Approach		0.38		
		≤ 16, ≥ Approach		0.59		
		16-20, < Approach		0.23		
		16-20, ≥ Approach		0.11		
		20-22, < Approach		0.46		
		20-22, ≥ Approach		0.28		
		22-24, < Approach		0.35		
		22-24, ≥ Approach		0.21		
Divided	1	> 24		0.70		
		≤ 50%		0.43		
		> 24		0.57		
		None		0.586		
	4	> 50%		2.95		
		≤ 50%		1.47		
		None		2.11		
		> 50%		2.99		
	Other	> 50%		14.26		
		≤ 50%		3.46		
		None		4.28		
Total	Unimproved	≤ 24		1.66		
		> 24		2.15		
		≤ 50%		1.72		
		> 24		1.16		
	Divided	> 50%		6.17		
		≤ 50%		3.35		
		None		4.73		
		Other		1.73		
	Total			0.70		
	Total			0.729		

*Accident rates were computed on the basis of the bridge length plus 500 ft (152.4 m) in each direction.

*Little or no shoulder width. 1 ft = 0.305 m



bridges can be a safety problem." As noted earlier and below, the results of the study can assist in identifying safety problems and possible countermeasures. The authors caution, however, that "it is essential to maintain design consistency in applying bridge accident countermeasures so that driver expectancy will not be violated; the application of countermeasures should be considered both on an individual basis and on a systemwide basis."

Acknowledging the above caveats, the following may be inferred from the study results:

- o Countermeasures requiring major reconstruction may not be as cost effective on the sole basis of safety benefits.
- o Reconstruction of a bridge for reasons other than safety should be to a design standard equal to that of the existing or planned approach roadway.
- o Bridges should not have curbs and "extremely sharp curves or steep grades should be avoided on bridges and their approach roadways..."
- o Properly installed approach guardrail and transitions are highly recommended accident countermeasures and should be combined with retrofits of the bridge rail system.
- o Minimizing access points and potential conflicts by better land use control may be an effective accident countermeasure.

Technology Transfer, University of Connecticut, Fall, 1986.

HAVE YOU HEARD THIS ONE?

This conversation was heard between a foreman and a project manager. The foreman called from the field to say that his crew got out to the job site and discovered they had forgotten their shovels. The manager's response was, "Well, they will have to send someone back to the shop to get the shovels. In the meantime, though, the workers can lean on each other."

VIDEO TAPES — NOW AVAILABLE

The Technology Transfer Center is beginning a video tape library. The VHS tapes listed below may be borrowed, at no charge, for a two week period. Please phone or write and request no more than two tapes at a time. Specify the tapes you want by the number in the left hand column.

- ST-201 The Winners—The Losers (13 minutes)**
Safe use of lift trucks including inspection and hazards facing operators.
- M-201 The Snowfighters (24 minutes)**
Methods, procedures, and equipment for snow removal on streets and highways.
- M-202 Down Is Up (20 minutes)**
Preventive maintenance is stressed to reduce down time on construction sites.
- M-203 The Choice Is Yours (18 minutes)**
Preventive maintenance on diesel engines is stressed to get maximum life from the engine.
- M-204 Signals: Read 'Em or Weep (20 minutes)**
Indications of problems with equipment.
- M-208 Roadway Maintenance Cost Analysis—Part I (50 minutes)**
Discusses equipment costs including depreciation, fuel, oil, grease, maintenance, repair, and capital investment.
Roadway Maintenance Cost Analysis—Part II (50 minutes)
Discusses maintenance operating costs relating to labor, equipment, materials, and overhead.
- M-209 Roadway Maintenance Cost Analysis—Part III (50 minutes)**
Discusses the cost of deferred maintenance.
Roadway Maintenance Cost Analysis—Part IV (50 minutes)
Gives ideas on how to present budget data to county commissioners and city councils.
- M-210 Maintenance of Highway Safety Hardware (45 minutes)**
How to provide safe roadside environments through periodic maintenance of the road side and its safety hardware.
- M-211 Maintaining Granular Surfaced Roads (18 minutes)**
Instructional guide to enable road grader operators to provide better maintenance of granular surfaced roads.
Snow Removal on Iowa's Secondary Roads (20 minutes)
Instructional guide for snowplow operators for winter road maintenance of secondary roads.
- M-212 Ditchmaster (10 minutes)**
Demonstration of the ditchmaster, a cost effective machine for improving roadside drainage and maintenance.
Lee-Boy Asphalt Maintainer (15 minutes)
Demonstration of the Lee-Boy, an asphalt maintenance machine.
Rosco Asphaltite Maintainer (15 minutes)
Demonstration of a pot hole repair machine.

M-213 Techniques for Pavement Maintenance and Rehabilitation Using Asphalt—Part I

Introduction (15 minutes)

Introduction to series of tapes dealing with using asphalt for pavement maintenance and rehabilitation.

Asphalt Components, Materials, Tests and Basics of Design (40 minutes)

Discusses the components of an asphalt paving structure from subgrade to the asphalt top.

M-215 Techniques for Pavement Maintenance and Rehabilitation using Asphalt—Part III

Sealing of Joints in Portland Cement Concrete (25 minutes)

Discusses cleaning and sealing of joints in Portland cement concrete. Discusses rehabilitation of Portland cement concrete roadways.

Surface Treatment of Pavement (54 minutes)

Discusses objectives and methods of applying seal coats, spraying of liquid asphalt, surface condition variables, spraying oil onto pavement and spreading aggregate.

M-216 Techniques for Pavement Maintenance and Rehabilitation Using Asphalt—Part IV

Cost Analysis (20 minutes)

Discusses methods and strategies for determining which method of maintenance is needed. Cost analysis is emphasized.

Recycling Procedures (35 minutes)

Describes recycling procedures with asphalt and shows some of the equipment used.

From page 2

SPOT PATCHING WITH PREMIX

Spot patching with premix is commonly used to repair potholes which are caused by poor design or construction practices such as too thin an asphalt surface, poor drainage or inadequate base. During bad weather, temporary repairs can be made to eliminate the potholes. This involves cleaning out the hole and filling it with a premixed patching material. However, as soon as possible permanent repairs should be made by spot patching with premix.

Crew required:

- | | |
|----------------|---|
| - Truck driver | 1 |
| - Laborers | 2 |
| - Flagmen | 2 |

Equipment required:

- | | |
|---------------------------------------|---|
| - Dump truck | 1 |
| - Portable roller or vibrating tamper | 1 |

- | | |
|----------------------------------|---|
| - Asphalt kettle | 1 |
| - Concrete saw or air compressor | 1 |

Material required:

- Hot asphalt concrete
- Liquid asphalt tack coat

Repair procedure:

1. Place signs and other safety control devices.
2. Cut a neat vertical edge with saw or jackhammer 4-6 inches outside the distressed area on all sides. Make cuts square with roadway dimensions.
3. Clean hole of debris and as much water as possible. Heat with torch if necessary.
4. Apply a tack coat to the vertical sides and bottom of the hole. The heated asphalt should be light and uniform.
5. Place hot asphalt concrete premix into the hole to be patched with layers not exceeding 3 inches and roll surface.

WORKSHOPS AND COURSES

USING THE NACE ACTION GUIDES AND TRAINING GUIDES

April 9 - 10, 1987
Atlanta, Georgia

This workshop is a one-and-a-half-day discussion of the 21 NACE Action Guides and 7 NACE Training Guides. The Action Guides offer county engineers and other public works executives guidance on the management and technical aspects of local roads and similar public works activities. The Training Guides are aids to training road crews and crew foremen. They will be provided as course materials.

The workshop will be held at the Radisson Inn in Atlanta. The registration fee is \$20.00. If you plan to attend, please let us know by March 25, 1987.

SURFACE TREATMENT WORKSHOP

February 3, 4, and 5, 1987
Atlanta, Macon, Tifton

The Technology Transfer Center and the Georgia Department of Transportation will offer three workshops on Surface Treatment. The workshop will explore the different types of surface treatment and their applications, advantages and disadvantages of surface treatment, materials and equipment which could be utilized, and inspection techniques.

The workshops will be held in the following locations on the following dates:

Atlanta February 3, 1987
(GDOT Research Lab—Auditorium)

Macon February 4, 1987
(Farmer's Market—Conference room)

Tifton February 5, 1987
(District DOT Office—Conference room)

These workshops are offered at no charge, and course materials will be provided. Please let us know by January 26 if you plan to attend.

CIVIL ENGINEERING REFRESHER COURSE

February 28 - March 28, 1987
Atlanta, Georgia

This refresher course in the fundamentals of Civil Engineering is intended to help those persons preparing for the Civil Engineering portion of the Professional Engineer's Examination this year. This course will be held for five consecutive Saturdays from 9:00 a.m. to 4:00 p.m. beginning on Saturday, February 28.

Topics include:

Structures
Engineering Economy
Surveying
Hydraulics
Soil Mechanics
Transportation Engineering
Environmental Engineering
Materials of Construction

The course fee is \$300.00 and includes all necessary classroom materials. To register by telephone, please call (404) 894-2400. Also, brochures are available from the Technology Transfer Center. Please register by February 18.

This course is a continuing education course, and participants who successfully complete the course will earn 3.0 Continuing Education Units.

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1-800-282-1275

DIRECTOR: JOHN MOSKALUK
EDITOR: MARTY MILLINER

PUBLICATIONS

Copies of the following publications are available free from the Technology Transfer Center:

* **CALIBRATION PROCEDURES FOR ROADMETERS**
Federal Highway Administration, 1986

This study, conducted by the Georgia Department of Transportation, compared roughness measuring devices in a carefully controlled field testing program. Using the results, a correlation program was conducted and a recommended calibration procedure was developed for response-type devices.

* **COMPARISON OF THREE COMPACTORS USED IN POTHOLE-REPAIR**
U.S. Army Corps of Engineers, 1984

This report is a summary of the results of a compaction study using recycled hot mix asphalt concrete conducted during August 1983 in a indoor facility at CRREL in Hanover, New Hampshire. This study compared three kinds of compactors for optimum performance, and also considered such factors as temperature of the asphalt concrete mix, number of passes, size and depth of patches, and the number of lifts to fill the holes.

* **COUNTERMEASURES FOR SIGN VANDALISM**
Federal Highway Administration, 1986

This manual describes how the nature and magnitude of a highway agency's sign vandalism problem can be determined, and the various countermeasures available. It presents guidelines for planning, implementing and evaluating anti-vandalism countermeasure program activities.

* **CULVERT INSPECTION MANUAL**
Federal Highway Administration, 1986

The Culvert Inspection Manual provides practical guidelines and procedures for inspecting the various types of box, pipe and long span culverts. Inspection procedures are outlined and illustrated in detail. Sample documentation forms are provided for recording each inspection. This manual is a supplement to the Bridge Inspector's Training Manual and was prepared in accordance with its procedures and rating systems.

* **DECAY IN WOOD BRIDGES: INSPECTION AND PREVENTIVE & REMEDIAL MAINTENANCE**
U.S. Department of Agriculture, 1985

This manual provides information on the characteristics of decay in wood bridges to aid bridge inspectors and bridge maintenance crews.

* **FIELD MAINTENANCE MANUAL FOR GEORGIA COUNTIES LOCAL ROADS AND STREETS**
Georgia Department of Transportation, 1977

This manual has been prepared to assist maintenance personnel in Georgia counties to identify roadway deficiencies and to determine the best procedures for correcting them. The manual is intended for use on a daily basis by field personnel and not as a shelf reference by top management.

* **IMPROVING GUARDRAIL INSTALLATIONS ON LOCAL ROADS AND STREETS**
Federal Highway Administration, 1986

This pamphlet is intended as a general guide to effective, low cost methods of enhancing highway safety with guardrail. The guidelines and recommendations included are based on actual situations and observations found in a series of national reviews. They reflect the actual needs and opportunities for highway safety improvements existing on many local road and streets.

* **RAILROAD-HIGHWAY GRADE CROSSING HANDBOOK, 2ND EDITION**
Federal Highway Administration, 1986

This handbook provides general information on railroad-highway at-grade crossings, including the physical and operational devices recommended for use at crossings and procedures for analyzing the traffic hazards present at crossings. Also included are statistical data on the 200,000± crossings currently in active use. This handbook is an updated version of a previously distributed handbook.

* **WORK ZONE TRAFFIC CONTROL: STANDARDS AND GUIDELINES**
U.S. Department of Transportation, 1980

This publication is a reproduction of Part VI of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). The standards contained in this

publication are applicable to all public roads regardless of type or class or agency having jurisdiction.

The following publications may be ordered from the Federal Highway Administration. Specify by report number, and send requests to: National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

* CONCRETE REMOVAL WITH ABRASIVE JET

Report No. FHWA-TS-85-221 (\$9.95)

This report provides an introduction of the waterjet techniques, a description of the abrasive waterjet system equipment used in the testing, and a discussion of the test results.

* IMPROVED METHODS FOR PATCHING ON HIGH-VOLUME ROADS

Report No. FHWA/RD-86/076 (\$16.95)

In 1983, a Federal Highway Administration contract study was initiated to identify and evaluate methods for patching pavement defects on high-volume roadways. Included within the scope of the work was the development and offering of suggestions for the improvement of the identified patching methods.

* STATE-OF-THE-PRACTICE RETRO-REFLECTIVE MEASUREMENT DEVICES FOR PAVEMENT MARKINGS

Report No. FHWA-TS-84-222 (\$11.95)

This implementation project was conducted to identify the current usage and availability of instruments used for making retroreflective measurements of pavement markings, as well as associated standards and causes of retroreflection from pavement markings.

M. JOHN MOSKALUK
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UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA

TECHNOLOGY TRANSFER CENTER

VOL. 5 NO. 2

SPRING 1987

RURAL TWO-LANE HIGHWAYS MOST HAZARDOUS

Rural, two-lane highways comprise 97 percent of the total rural highways in the United States. Travel on this two-lane system amounts to 66 percent of rural highway travel and 30 percent of all U.S. highway travel. The accident rate on these highways is higher than that on all other kinds of rural highways except four-lane, undivided roads. Two-lane, rural highways also have a higher percentage of both head-on and single-vehicle accidents than any other kind of rural highway. An FHWA study of safety problems on the two-lane, rural system revealed the following:

*Intersections, horizontal curves and bridges show the highest probability of accidents.

*Low-cost safety improvements such as signing and delineation tend to give high benefit-cost ratios even when the accident effectiveness is small.

*If a signing project reduces accidents to any degree, usually it will be cost-effective.

*High priority should be placed on standardizing traffic control devices, being careful to avoid unnecessary signs.

Although signing and delineation improvements were found to be "highly cost effective," other cost effective improvements included the following:

- o selective removal of trees,

- o placement of centerlines on curves,
- o placement of guardrails on the outside of curves,
- o pavement marking at intersections,
- o low-cost sight distance improvements at intersections.

The study results indicated that \$4 billion to \$9 billion in safety funds for two-lane, rural highways may be justified over the next 20 years.

The problems and needs of agencies having jurisdiction over two-lane, rural highways are unique. A vast network of highways must be managed, and on most of the highways the occurrence of an accident is rare. Determining whether a section of, or particular spot on, a highway truly constitutes a safety hazard is difficult, and treating such a hazard often is not cost effective.

The goal at the federal level then is to support the optimization process at the state and local levels by providing training in processes for improving safety; analysis procedures and programs; general guidelines on countermeasures cost effectiveness; and detailed statistical data on accident rates, accident severeness and kinds, accident-reduction factors, operational benefits, and improvement costs and service lives.

Reprinted from Northwest Technology Transfer Center Bulletin, Winter 1985, No. 5).

EDITOR'S NOTE



The Georgia Tech Technology Transfer Center is very happy to be presenting a workshop on the NACE Action Guides and Training Guides. (More details are given in the workshop announcement in the back of this issue.) This workshop is the first workshop that the Technology Transfer Center has held here on campus. We hope that this location will be convenient for everyone involved, because we want you to see us in our natural habitat! Please note that the NACE Action Guides and Training Guides (a \$95 retail value) will be provided as course materials. Call as soon as possible to register, as space is limited.

Our video tape library continues to grow. A listing of the tapes which we have acquired since the winter issue of Tech Trans is given in the back of this issue. (If you have lost your copy of the original list, please contact the Center, and we will provide you with another one.) We have had many requests for video tapes already, but there is certainly room for improvement in the response. Please contact the Technology Transfer Center and

request the tapes you need. If they are already checked out, we can put you on a waiting list.

The data collection equipment will soon be available again. Call and sign up to get this equipment for your spring counts!

Thank you to everyone who helped clean out the office by requesting publications. Unfortunately, everyone seemed to want the ones of which we only had ten or fifteen. There are still plenty of the following publications:

- Comparison of Three Compactors Used in Pothole Repair
- Improving Guardrail Installations on Local Roads and Streets

We will provide multiple copies of these publications with great rejoicing.

As editor of Tech Trans, I am very interested in having you contribute to this publication. You can help to "transfer technology." Write an article about innovative practices that you have tried and your experience with it, good or bad. You might also want to contribute an article about someone in your agency who is particularly outstanding. Maybe you just want to let the rest of Georgia know what is going on in your area. If you have information which you feel would benefit the rest of us, let us know. You may get your name in print!

thanks!



MAINTENANCE TIPS

UNPAVED SHOULDER REPAIR

RESHAPING SHOULDERS

When rutting, corrugations, or ridges occur on an unpaved shoulder, the reshaping of the shoulder becomes necessary. Ruts, corrugations, and ridges in earth shoulders are caused by erosion and/or improper compaction of the shoulder material. These deficiencies are normally found in shoulders with slopes greater than 5:1 and in shoulders that have little or no ground cover to prevent erosion. Corrugations may show up in newly reconditioned shoulders within 6 months after construction. Initial ruts, corrugations, and ridges are not a severe deficiency. However, if they are allowed to remain they will create drainage problems that may result in areas of low shoulder and hazardous driving conditions for vehicles.

Crew required:

Equipment operator	1
Laborers	2
Flagmen	1

Equipment required:

Motor grader	1
--------------	---

Material required:

None

Repair procedure:

1. Place signs and other safety control devices.
2. Remove roadway signs and mailboxes from shoulder to be repaired.
3. Cut high spots with motor grader, pulling material toward the roadway.
4. Blade the material back onto the shoulder making sure all low spots are filled. Make certain the new shoulder is level with the adjacent pavement

and sloped toward the ditch to permit drainage of water.

5. Roll with motor grader wheels to compact loose material.
6. Replace signs and mailboxes.
7. Clean up area and remove signs.

RECONDITIONING SHOULDERS

When unpaved shoulders are high, low, or narrow, they should be repaired by reconditioning the shoulder.

High shoulders are those in which the shoulder surface is higher than the adjacent pavement, preventing pavement drainage. They are caused by buildup of vegetation along the shoulder or improper drainage of shoulder allowing the buildup of earth.

A Low shoulder is one where the surface of the shoulder is below the surface of the adjoining pavement. It is caused by a build up of the pavement surface and settlement or erosion of the shoulder. Often pavements are overlaid causing a rise above the shoulder equal to the depth of the overlay. This condition creates a safety hazard for the driver. Low shoulders may also result in wide gaps at the pavement-shoulder joint, allowing water to penetrate into the subgrade and cause edge or alligator cracking.

Narrow shoulders are those which are too narrow to permit a vehicle from pulling completely clear of the roadway (less than 8 feet wide). Most narrow shoulders are the result of insufficient width of right-of-way at time of construction or decrease of shoulder width due to widening of the pavement. Narrow shoulders are not a serious deficiency as long as a minimum shoulder width of 4 feet is maintained at all times and areas 8 feet wide are provided at intervals of every one-half to one mile.

Crew required:

Equipment operators	2
Truck drivers	2-4
Laborers	2
Flagmen	2

CONTINUED ON PAGE 6

NEWS BRIEFS

Local government offers the most for the money when compared to second-place federal and third-place state governments, according to "1986 Changing Attitudes on Government and Taxes." The Gallup survey, for the Advisory Commission on Intergovernmental Relations, found that local government has been rated at the top, or tied for the top, five times since 1972. Responses to other important questions involving local, state, and federal government can be found in the report, available for \$3 from the Commission in Washington, DC 20575.

In the course of a single project, Aiken County, South Carolina, obtained a landfill without buying or preparing the land, reclaimed strip-mined areas, made money from solid wastes, and fostered public/private cooperation.

The county saved \$3 million by renting a former strip mine for \$1 per year. Its 60-acre capacity was filled with solid wastes and covered. Grass and trees were planted. The company that formerly used the mine contracted to mine the methane gas generated from the landfill. Another firm constructed 22 shallow wells to tap the gas and pipe it to a nearby plant.

The completed landfill became a revenue producer. The former mine owner pays Aiken County a royalty for the gas (\$1,800 in the first year of production). Project start-up costs were privately funded at no cost to the county. The mine owner meets its annual fuel needs at a 25% savings. An estimated 300,000 cubic feet of methane gas is produced daily, enough to heat 300 houses for one year.

In ceremonies at Auburn University, Auburn, Alabama, an agreement was signed between the National Asphalt Pavement Association (NAPA) Education Foundation and Auburn University formally establishing the National Center for Asphalt Technology (NCAT), a national center for research into all phases of asphalt pavement design, construction and performance.

The NCAT is a scientific and technical research institute under the funding auspices of the NAPA Education Foundation which also acts as a central repository and distribution center for all manner of resources and information on asphalt. Headquartered at Auburn University, the center will provide a national and international focus to conduct asphalt research, to develop model education and training programs and to provide methods for bridging the gap between theory and field practice.

A new and innovative informational exchange, the Steel Bridge Forum, has been established to communicate to all involved in the bridge market the latest ideas for improving the cost effectiveness and performance of the nation's steel bridges. The Forum currently functions under the auspices of the American Iron and Steel Institute (AISI).

Its activities—promulgating the most successful bridge design, construction and rehabilitation techniques—will reflect the needs and interest of all key groups involved with steel bridges. These include owners, consulting engineers, general contractors, steel producers, steel fabricators and erectors.

Highway construction costs increased 4.1% in the third quarter of 1986, notes Federal Highway Administrator Ray Barnhart. This increase coupled with delays in construction starts caused by the failure of Congress to agree on the Highway Program Reauthorization may continue to hike project costs.

Hollywood, Florida, has saved money by contracting out for vehicle repairs. In April 1986, the city entered into an agreement with the Sheridan Vocational Technical Center under which the center's students do auto body repairs on all city-owned vehicles.

The program has worked very well. An average of six vehicles per month are brought to the center for repair. Hollywood has reduced auto body repair

expenses about 40%. The city projects a savings of \$17,853 over the first full year of the program's operation. In addition, average turnaround time has been reduced from 30 days to 18 days. Students doing the work are supervised carefully and the quality of the repairs has been excellent.

Reauthorization of the federal-aid highway program will be top Senate priority in 1987, according to Quentin Burdick (D.-N.D.), incoming chairman of the Senate Environment and Public Works Committee. During a meeting of the American Transportation Advisory Council last November, held at the American Road & Transportation Builders Association (ARTBA) headquarters, he assured industry leaders of early action.

Burdick told ATAC members that he and outgoing committee chairman Sen. Robert Stafford (R.-Vt.) would work closely together to guide the highway bill quickly through committee. He predicted the full Senate would consider the highway bill shortly after repassing the Clean Water Act, vetoed by President Ronald Reagan in November.

The new chairman said he believed the differences existing between the Senate and House versions of the reauthorization legislation could be resolved. He suggested that compromises already reached in the 99th Congress' conference committee should stand.

FROM PAGE 3

Equipment required:

Dump trucks	2-4
Roller	1
Motor grader	1
Front end loader	1

Material required:

Gravel or imported borrow

Repair procedure:

1. Place signs and other safety devices.
2. Remove roadway signs and mailboxes on shoulder.
3. Cut shoulder wedge approximately 4 inches deep at pavement edge and slope to desired shoulder width (8 foot minimum if right-of-way available, 4 foot absolute minimum).
4. Work material cut from shoulder back into wedge. If additional material is required, spread material from truck and work in with motor grader. If excess material at shoulder, remove and haul away.
5. Shape shoulder with motor grader to conform with roadway and slope toward ditch.
6. Roll as required for proper compaction.
7. Replace roadway signs and mailboxes.
8. Clean up area and remove signs.



DOT REPORTS INCREASED USE OF SAFETY BELTS NATIONWIDE

Secretary of Transportation Elizabeth Hanford Dole recently reported that "more motorists than ever before are buckling up" and that "the increased usage of safety belts is saving hundreds of lives."

The Secretary said a new DOT survey in 19 major cities--conducted the first six months of 1986--found that safety belt use by drivers reached 34.2 percent, up from 23 percent a year ago.

"Safety belt usage in the United States is on the rise as more and more Americans realize the importance of protecting themselves when riding in cars," Secretary Dole said. "Since 1982, when we began a national effort to encourage belt use, usage has more than tripled. But more importantly, many lives have been saved and countless injuries have been reduced in severity or avoided altogether."

The Secretary said there was a seven percent reduction in front seat occupant fatalities in eight states that had mandatory safety belt use laws in effect for at least part of 1985.

"The increase in usage is helped considerably by belt use laws that have been enacted in 26 states and the District of Columbia," she said.

The Secretary noted that states with belt laws reported increases in use from an estimated 15 to 20 percent before a law to about 40 to 50 percent after a law became effective. Two states, Hawaii and Connecticut, report belt use above 70 percent.

"The full benefits of safety belts will be realized only when all occupants buckle up every time they get in an automobile," the Secretary said. "Belgium, Germany and the United Kingdom have shown that belt use rates over 90 percent can be achieved and sustained."

Secretary Dole also noted that the 19-city survey showed the percent of children

in cars who were in child safety seats was 68.4 percent compared to 56.2 percent for the July-December 1985 reporting period. She said the rate for toddlers (ages 1-4) was 68.8 percent and the usage rate for infants (under 1 year of age) was 63.7 percent. All 50 states have laws requiring children to be protected while riding in cars.

The DOT survey, which was first initiated more than a decade ago, includes these cities: Boston, MA, Providence, RI, New York, NY, Baltimore, MD, Pittsburgh, PA, Chicago, IL, Minneapolis/St. Paul, MN, Fargo/Moorhead, ND, Miami, FL, Atlanta, GA, Birmingham, AL, New Orleans, LA, Seattle, WA, San Francisco, CA, San Diego, CA, Los Angeles, CA, Phoenix, AZ, Houston, TX, and Dallas, TX.

Reprinted from "U.S. Highways," Fall 1986.



BUCKLE UP.

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EDITOR: MARTY MILLINER

SPECIAL FEATURE: WORK ZONE SAFETY

by Richard D. Morgan
Executive Director, FHWA

One of the Federal Highway Administration's primary concerns is the safety of motorists, pedestrians and construction workers on federal-aid projects. Work zone safety is not a new issue, but it is a persistent one.

More than 10 years ago, FHWA initiated a rulemaking that resulted in requirements for stricter traffic control through and around construction areas. We took some heat on this 1978 rule from some of the states and from the construction industry, but we believe its implementation has helped to improve work zone safety and traffic flow.

Today, maintaining the safety of work zones requires more vigilance than ever due to the increasing amount of resurfacing, restoration, rehabilitation and reconstruction work spurred by the 1982 Surface Transportation Assistance Act. This work has led to increased congestion and accidents, and some serious problems are occurring.

For example, increased exposure over the last four years has resulted in a rise in work zone fatalities from about 500 in 1982 to about 700 last year. During this period, work zone fatalities just on the Interstate system increased from about 90 to 200. This increase is of concern even considering that the Interstate system carries high traffic volumes and has experienced an increase in the number of construction and maintenance projects.

The most common type of work zone fatality during daylight hours involves vehicle-to-vehicle collisions. This points out the need to provide proper guidance and information to the driver so that he will know what to expect and what action to take.

More than 50 percent of work zone fatalities occur at night, usually when a vehicle collides with a fixed object, such as a roadside barrier or barricade. This

indicates that we need to properly place and maintain these devices and provide clear delineation.

Occasionally, I hear that drunk drivers are the cause of a disproportionate number of work zone accidents. Our analyses have found that alcohol involvement is about the same for work zone fatalities as for all highway fatalities. However, it is apparent that all drivers, whether impaired or not, will have difficulty negotiating a poorly delineated work zone.

Interestingly, tractor trailers are over-represented in work zone fatalities. Normally, tractor trailers are involved in about 10 percent of all fatal accidents. In work zones, they are involved in more than 20 percent of fatalities. Pedestrians in work zones, particularly workers, also experience a higher than average fatality rate.

All in all, this accident data shows that there has been a rising trend in work zone fatalities and we have a legitimate cause for concern.



We know that the safest work zone is one where there is no traffic, but in most cases, detouring traffic around a work area is not possible. The next best solution is to develop effective traffic control plans

CONTINUED ON PAGE 9

MR. MORELAND REPORTS 1986 LEGISLATION

Thomas D. Moreland, Commissioner of the Department of Transportation, reports that 1986 legislation included HB 705, a single-bid bill. This bill authorizes the department to award contracts when only one bid is submitted for state-funded and federal-aid projects. Before enactment, the department was prohibited by law from awarding such contracts. Over the past year alone, Moreland says, the old law required rebidding of 119 projects, many of which were in rural areas. The new law continues to reserve the right of the department to reject single bids when deemed appropriate. The new law also authorizes the department to negotiate with the lone bidder on state-funded projects, if the bid exceeds the department's cost estimate.

HB 1259 covered fiscal year 1986 state supplemental appropriations. State budget surpluses in recent years have allowed state lawmakers to begin funding Georgia's Economic Development Highway Program--a 2,500-mile, \$4.5-billion, state-funded system of multi-lane highways designed to link communities with the Interstate system. The department was budgeted \$80 million to continue work on two segments of this system--the Appalachian Highway in North Georgia and Corridor Z, and east-west route in South Georgia. Since motor fuel tax funds go directly to the DOT and are used for funding the regular highway program, funds for the Developmental Highway Program come from state general funds. Also, supplemental funds totalling \$24 million were appropriated for Georgia's Local Assistance Roads Program.

HB 1300 covered general appropriations. The department was budgeted an additional \$20 million in general funds for the Economic Development Highway Program. This appropriation authorized work on new parts of the system.

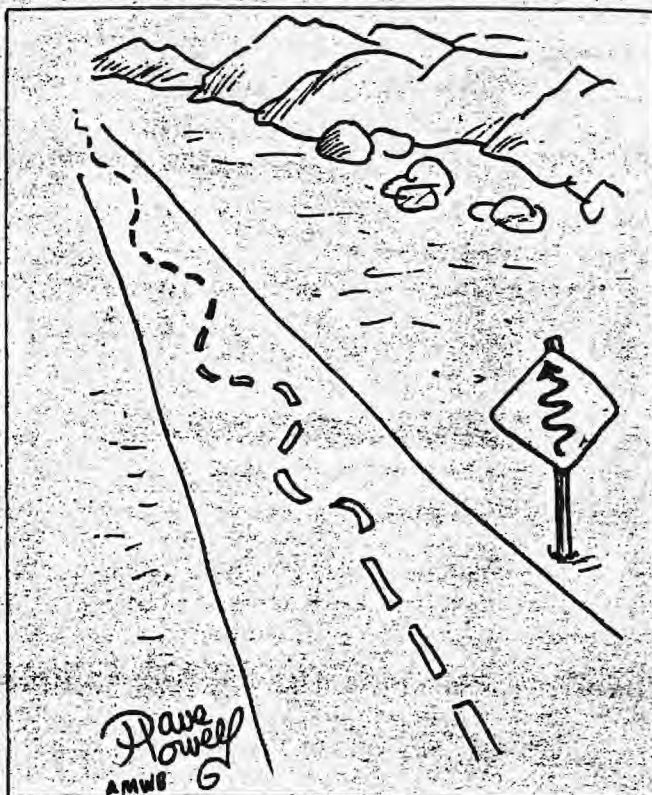
HB 1320 made it a felony to interfere by violent means with DOT enforcement officers in the discharge of their duties. These officers enforce laws governing commercial trucking.

HB 1361 established the State Commission on Condemnation of Public Property.

HB 1489 was a bill to control blasting and excavating operations, so as not to disturb underground utility facilities. The DOT is responsible on all utility facilities, other than gas, which are shown on the project plans. Violation of this rule is punishable up to \$3,000.

HB 1712 covered tollway funding. It grants the DOT the authority to use federal funds to finance construction of tollways. A 25% limitation on outside (other than toll revenues) funding was also removed.

HB 1712 allows the use of a simultaneous location and design hearing for state-funded projects. The practice is allowable on federal-aid projects.



APWA REPORTER / NOVEMBER 1985

ACKNOWLEDGEMENT

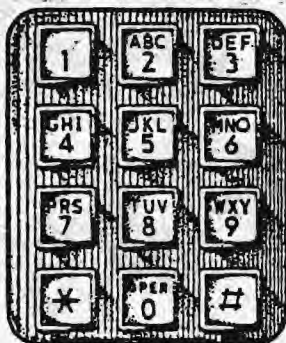
The Technology Transfer (T2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual State Departments of Transportation. Its purpose is to translate into understandable terms the latest state-of-art technologies in the areas of roads, bridges, and public transportation, to local and county highway and transportation personnel.

The T2 Center at Georgia Tech is sponsored by the Georgia Department of Transportation and provides information and counsel to more than 500 municipalities and counties in our state. This newsletter is designed to keep you informed about new publications, new techniques, and new training opportunities that may be helpful to you and your community. Individuals wishing to receive future copies of this newsletter at no cost may send their requests to:

M. John Moskaluk
Technology Transfer Center
School of Civil Engineering
Georgia Tech
Atlanta, GA 30332



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FROM PAGE 7

(TCPs) which provide a safe working environment while maintaining a smooth flow of traffic.

Safe traffic handling has to be designed into the project, not added as an afterthought. Preconstruction strategies favored by FHWA include: improving traffic engineering on alternative routes; promoting the use of high-occupancy vehicle (HOV) lanes; using incentive/disincentive clauses in contracts to accelerate construction progress; and, early coordination with community officials, the public and contractors.

To emphasize the need for greater use of these strategies, a national conference was held this September in Chicago, hosted by FHWA and the Transportation Research Board.

However, the best TCP in the world is no good unless it is properly implemented during construction. One growing problem is driver disregard for traffic control devices in work zone areas. Contractors and government officials must be certain they are not contributing to the problem by allowing the use of inappropriate and improperly maintained signaling devices. These result in driver disrespect and poor compliance.

Work zones should be reviewed frequently by other than project personnel to assess the effectiveness of the traffic control procedures. These assessments are useful for identifying successful procedures and techniques as well as areas needing improvement.

Last, but not least, we must recognize that despite diligent planning and design, certain strategies may not work on any given project. A willingness to make changes where necessary is vital.

Other areas that need improvement include work zone accident analysis, training of flaggers and other workers, and public information and education. FHWA will be emphasizing these in the future.

Reprinted from "U.S. Highways," Fall 1986.



*** COMPARISON OF THREE COMPACTORS USED IN
POTHOLE-REPAIR**

U.S. Army Corps of Engineers, 1984

This report is a summary of the results of a compaction study using recycled hot mix asphalt concrete conducted during August 1983 in a indoor facility at CRREL in Hanover, New Hampshire. This study compared three kinds of compactors for optimum performance, and also considered such factors as temperature of the asphalt concrete mix, number of passes, size and depth of patches, and the number of lifts to fill the holes.

*** IMPROVING GUARDRAIL INSTALLATIONS ON
LOCAL ROADS AND STREETS**

Federal Highway Administration, 1986

This pamphlet is intended as a general guide to effective, low cost methods of enhancing highway safety with guardrail. The guidelines and recommendations included are based on actual situations and observations found in a series of national reviews. They reflect the actual needs and opportunities for highway safety improvements existing on many local road and streets.

A WORKSHOP ON:

NACE ACTION AND TRAINING GUIDES

ATLANTA, GEORGIA
APRIL 9 AND 10, 1987

This workshop is a one-and-a-half-day discussion of the 21 NACE Action Guides and 7 NACE Training Guides. The Action Guides offer county engineers and other public works executives guidance on the management and technical aspects of local roads and similar public works activities. The training guides are aids to training road crews and crew foremen. These guides are a \$95 value and will be provided at no charge as course material.

The workshop will be held at Georgia Tech in Room 215 of the Instructional Center. (The location of this workshop has been changed since the last newsletter and the brochure have gone out, so please make note of this correction.) There is no registration fee, but it is necessary that you register as soon as possible, since space is limited.

VIDEO TAPES

The Technology Transfer Center now has a video tape library. The VHS tapes listed below have recently been added to the library. (Please check the winter issue of Tech Trans for the previous listing.) The tapes may be borrowed, at no charge, for a two week period. Please write or phone and request no more than two tapes at a time. Specify the tapes you want by the number in the left hand column.

DC-204 Tied Concrete Shoulder (10 minutes)
Shows construction of tied concrete shoulders, undersealing of existing pavement and full-depth repair of the pavement.

Recycling D-Cracked Concrete Pavement (12 minutes)

Discusses the reasons for the use of concrete recycling over conventional methods of construction.

Bonded Concrete Overlay (12 minutes)

Shows a bonded concrete overlay on existing concrete pavement.

DC-205 Interstate Reconstruction - Part I (12 minutes)

Recycling existing D-Cracked pavement as aggregate for new concrete pavement.

Whitetopping (7 minutes)

Discusses placing a concrete overlay on distressed asphalt concrete.

Design for Quality (12 minutes)

Shows recycling of concrete pavement and replacement with continuously reinforced concrete pavement, bonded concrete overlay and tied concrete shoulders.

DC-206 Interstate Reconstruction - Part II (13 minutes)

Shows add-on tied concrete shoulders, diamond grinding for smoothness and establishing new transverse joints.

Recycling Continuously Reinforced Concrete Pavement (10 minutes)

Shows the recycling of existing continuously reinforced concrete pavement as aggregate for new concrete pavement.

Unbonded Concrete Overlay (12 minutes)

Construction of a full-depth unbonded overlay over a reinforced concrete pavement.

DC-207 Testing of Asphalt Cement (24 minutes)

Procedures for various tests of asphalt cement including flashpoint, penetration, ductility solubility, spot softening point, specific gravity and thin film over tests.

Determination of Asphalt Content in Paving Mixtures (20 minutes)

Procedures for determining asphalt content for proper life and serviceability of asphalt cement.

Budgeting for Rehabilitation (25 minutes)

Present economic situation of restoring paved highways and evaluation of pavements for determination of priority for restoration.

Asphalt Emulsion Spray Applications (20 minutes)

Reasons for using asphalt emulsions, what constitutes asphalt emulsions, how they work, and processes for applying asphalt emulsions.

Aggregate Blends (40 minutes)

Demonstrates graphical procedure for blending aggregate sources to meet proper specifications.

DC-208 AASHO Road Test Construction and Materials (27 minutes)

Discusses materials and construction of extensive test facilities constructed in 1956 by AASHO to test different types of road surfacings, bases, bridges and methods of construction.

Pavement Research (37 minutes)

Objectives, methods, and principle results of pavement research in the AASHO Road Test.

The Road to Better Roads (14 minutes)

Summarizes the purposes and procedures of the AASHO Road Test and discusses what is being done today to improve roads.

Accident reports can be a valuable tool in helping you find problem areas, but sometimes they can be more humorous than helpful. The statements below are taken from actual insurance forms.

- * Coming home, I drove into the wrong house and collided with a tree I don't have.
- * I collided with a stationary truck coming the other way.
- * I had been driving over 40 years when I fell asleep at the wheel and had an accident.
- * The indirect cause of the accident was a little guy in a small car with a big mouth.
- * The other car collided with mine without giving warning of its intentions.

- * I had been shopping for plants all day and was on my way home. As I reached an intersection, a hedge sprang up obscuring my vision, and I did not see the other car.
- * My car was legally parked as it backed into the other vehicle.
- * I told the police that I was not injured, but on removing my hat found that I had a fractured skull.
- * In my attempt to kill a fly, I drove into a telephone pole.
- * I was on my way to the doctor with rear-end trouble when my universal joint gave way, causing me to have an accident.

M. JOHN MOSKALUK
TECHNOLOGY TRANSFER
SCHOOL OF CIVIL ENGINEERING
GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

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TECHNOLOGY TRANSFER CENTER

VOL.5 NO.3

SUMMER 1987

TIPS FOR SAFE MOWER OPERATION

Mowing accidents are costly in terms of both human suffering and equipment damage. All tractors and mowing machine operators should be thoroughly trained in proper handling of their equipment, as well as proper mowing techniques. The following operator tips should help reduce accidents that occur while driving and operating mowing machines:

Wear only high-top work shoes or boots that are in good condition. Never wear tennis shoes while operating a mower. Clothing should fit well and not have large or heavy cuffs. Loose jewelry that might become caught in the machine's moving parts should not be worn.

Never operate a mower that has a serious mechanical defect. If there is any indication that the mower is not in good working order, have it checked before taking it out into the field. Make sure that your machine is up-to-date on its maintenance upkeep.

Never climb onto or off the tractor while it is in motion. Maintain three points of contact (for example, both hands and one foot) while getting on or off the tractor. Fasten your seat belt before starting the engine. It is a proven fact that the safest place you can be in the event of a tractor accident is belted on the machine within the protection of the safety frame.

Never allow any passengers on the tractor. Tractors are designed for only one person--the operator--and additional riders can disturb the stability of the machine. Also, never allow anyone to stand between the tractor and the mowing imple-

ment. Any sudden movement of either could cause a serious injury.

Put all gear shift levers in the neutral or park position before attempting to start the engine. If your tractor has a standard transmission, depress the clutch before starting the engine.

Driving on Public Roadways

Exercise extreme caution while driving and maneuvering the tractor on public roadways. The operator is responsible for keeping the mower under control at all times. Driving at excessive speeds results in a large number of tractor accidents. The risk of overturning increases when the tractor is being driven at road speeds. Quick maneuvers also increase the likelihood of overturning and must be avoided. Some tractors can be overturned by turning too quickly at only 8 m.p.h. or less on level ground. Using the brakes while turning can also cause the tractor to overturn.

Twenty-five percent of all tractor fatalities each year occur when the tractor is being driven on public roads and highways. Many of these accidents are related to the fact that the tractor is driven at a much slower speed than other traffic. Before taking your machine out on the highway, always be sure that it has prominently displayed slow-moving vehicle signs, as well as working warning flags and lights.

Operating the tractor at high speeds on the highway is extremely dangerous. It can cause the tractor to go out of control and run off the road, or cause the mowing implement to hit a fixed obstruction. If

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EDITOR'S NOTE

The Technology Transfer Center wishes Mr. Tom Moreland all the best in his future endeavors. We welcome Mr. Hal Rives as the new Commissioner and hope that he will continue to support the Center in the future as Mr. Moreland has in the past.

A total of 94 persons participated in the Surface Treatment Workshops which were held recently. We appreciate the work of the GDOT in making this workshop possible. We are especially grateful to our instructors, Otis Babcock, Gene Slaughter, and Bob Adams.

We have two workshops coming up very soon. A workshop dealing with the new uses of geotextiles will be held in late June. Workshops on the transportation applications for microcomputers will be held at various locations in mid-July. Be looking for announcements concerning these workshops.

I would like to call your attention to the article on page three of this issue entitled, *The Value of Training*. This article is a good background for my sales pitch concerning the Technology Transfer Center. It discusses the importance of keeping up with current technology through workshops, conferences, and courses. You have in us, the Technology Transfer Center, a wonderful opportunity to do just that. We are here to provide training and information to you at little or no cost to you or your organization. I urge you to take advantage of our services, and then let your managers and elected officials know how you benefited. We need your moral support to maintain our financial support.



NEWS BRIEFS

- o U.S. Transportation Secretary Elizabeth H. Dole has announced that the Federal Highway Administration has begun a comprehensive rulemaking procedure to establish a federal alcohol intoxication standard for commercial motor vehicle operators. When established, the standard will apply to commercial truck and bus drivers in both interstate and intrastate commerce.

The Commercial Motor Vehicle Safety Act of 1986 directed the FHWA to contract with the National Academy of Sciences for a study that will review the effects of reducing alcohol concentration (BAC) standard from 0.10 percent to 0.04 percent, or some level in between. The Act specifies that failure to adopt regulations by Oct. 27, 1988 would automatically result in the adoption of a 0.04 BAC standard.

- o Thin overlays of asphalt often lose their bond with the previous pavement surface. This usually occurs in the area of the paint strips on the old pavement and eventually results in cracking of the center line.

The problem begins with a small crack along the sides of the paint strip on the new asphalt layer. This is thought to be caused by the different thermal expansion coefficient of the marking material and the asphalt. The cracking accelerates the distress caused by the debonding of the two asphalt layers.

- o The Wall Street Journal recently ran an article about potholes. It seems an enterprising individual in the Washington, D.C., area supports his wife and seven kids by waiting around potholes for hubcaps to fall off cars when wheels drop into the potholes. If the motorist stops, the fellow helps retrieve and replace the hubcap as a free service. If the motorist does not stop, the hubcap is added to the entrepreneur's sizable inventory which is housed in a baby-

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THE VALUE OF TRAINING

by Harry Bisco, P.E.

Director of Public Works

City of Allentown, Pennsylvania

Practically everyone is qualified for a job when first employed by a firm or municipality. That is, if the person interviewing us for the position does his interview properly. By virtue of our education, training, or experience, or by a combination of all three, we are selected to begin work for that particular firm or municipality. After a trial period, usually 90 days, we become permanent employees, and along with that, comes a feeling of security.

How long we hold a job depends on several conditions: Is the job we have undergoing change? Or is it one that has had few innovations or improvements over the years? There are very few jobs of this type. So, we can't relax and have one year's experience and repeat that same experience year after year until retirement.

Everything is undergoing change. Some occupations change more rapidly than others, especially in the municipal workers' area. At one time, the only way you could get a job or advance in this type of work was through political avenues. Once established in the job, you had security as long as that party or elected officials were in power. We are fortunate that most of this is gone today. Those chosen are mainly selected because of their ability, qualifications, and experience. This change was brought about by public awareness, when many realized that unqualified people spending their tax dollars were a burden on their pocketbooks.

Today, the shadow of "Privatization" shows over our shoulders, threatening the positions of those people who are not innovating, progressive, and cost-conscious.

Professional associations have, for years, developed new ideas, training programs, and more efficient equipment to cut the cost of services.

Every association or profession offers training courses that are taught by the leaders in their field, most of whom are volunteering their services in order to keep the cost down. Most fees are used for lodging, food, and transportation, but even

those costs have risen with inflation. Many municipalities feeling the financial crunch are reluctant to fund training; however, the dividends returned to them in savings as a result of such training are many, many times the cost. Using the cost of training as an excuse not to send an employee to a school is doing a disservice to the community.

I have never attended a conference where I have not saved my municipality several times the cost of attending.

Last year, I was engaged as an Expert Witness in three lawsuits against three different municipalities. My job was to testify as to what were the standard procedures followed by a majority of municipalities when plowing snow. I was instructed to find out how many courses on snow removal were offered in the last five years within 100 miles of the municipal employees being sued, and what the costs were of such courses.

There were courses conducted by the Department of Community Affairs of that State each of the five years. One was 15 miles from the community being sued. Due to the fact that these employees did not follow accepted practice, and had not attended any courses of any time, they were found negligent. The judge admonished the employees, and said that it was no excuse that the community could not afford to send them. They were told that they should have paid their own way, as they have as much responsibility to know the latest techniques as their elected officials.

In all three cases, the question of punitive damages were brought up, and the responsibility was placed on the employee for not obtaining the necessary training to do the operation efficiently with the latest techniques.

Last, but not least, training makes leaders out of men; and leaders are more likely to get promoted than survivors or followers.

The great Henry Ford once said, "The best investment a man can make is in himself!"

The value of training--PRICELESS!

RTAP, Moving Forward Newsletter, April 1987, Vol. 4, No. 4. The Pennsylvania Local Roads Program, The Pennsylvania State University, University Park, PA.

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blue school bus. The fellow parks his bus on busy street corners and sells the hubcaps for around \$25 each.

Sounds farfetched? Well, at one location there were four potholes—two in the west bound lanes, and two in the east bound lanes. In two days, he amassed "about 400 hubcaps" from that one location. The moral of this is there's more to the problem of pothole repair than sometimes meets the eye—you need to look at the "hole" story!

- o Highlands County, Florida has instituted an educational program to reduce the incidence of theft and vandalism of signs. They have enlisted the aid of the high schools in the county, presenting slide programs to driver training classes and high school seniors. The programs focus on the possible consequences of a stop sign being stolen, etc.

- o School bus vandalism has been reduced significantly in Montbillard, France by a campaign to enlist the cooperation of local high school students in designing the bus interior. Design competitions among local high schools resulted in new bus seats, interior posters, a distinctive exterior for "Cool Le Bus," and installation of a stereo hi-fi tape recorder on the bus. Students bring cassettes to play during the bus ride which has created a new problem: students ride past their stops waiting to hear the end of the tape. Transit buses might benefit from similar programs.

- o Legislation has been introduced in the Senate that would impose a new federal excise tax on gasoline and motor fuels for deficit reduction purposes. The measure, S. 798, was introduced by Sen. Lowell Weicker (R-Conn.) on March 19.

Under the Senate proposal, a tax of 10 cents per gallon would be imposed on the motor fuels beginning Oct. 1, 1987, 20 cents per gallon beginning Oct. 1, 1988, and 30 cents per gallon beginning Oct. 1, 1989. Half of the new revenues generated by the excise would flow into a new "Public Debt Repayment Trust Fund." The remaining revenues would be retained in the Highway Trust Fund.

The proposed tax is estimated to raise over \$50 billion, according to Weicker. The senator commented, "More revenues are needed to reduce the deficit and continue our investments in humanity."

- o The American Automobile Association recently changed its position on the 55 mph speed limit, urging that states should be given the option of selective increasing the maximum speed limit on some limited access highway segments.

The policy change was based on declining popular support for the law and a decline in the highway fatality rate, despite rising average highway speeds. AAA studies showed that public support declined from 72% in July, 1985 to only 50% in September, 1986.

The AAA recommendation urges that the 55-mph limit should be kept for heavy vehicles in view of the higher stopping distance required for those vehicles. It is further stated that any legislative move for selective increase should require appropriate follow-up study of the effects of such increases on safety.

- o Drivers who fall asleep on Britain's motorways may soon be awakened by whining noise and vibration if they swerve towards the emergency hard shoulder portion of the road.

Three British counties are carrying out tests of the new proprietary system called "Vibraline". Originally developed in the Netherlands, it has now been patented and is being marketed in Britain. "Vibraline" consists of specially designed white rumble strips seeded with tiny glass beads to reflect car headlights.

The British company which distributes the Dutch system says: "When a driver strays onto the line, the bumps in it cause whine, and vibration also travels through the steering of the car. It is not enough to cause a panic, but it alerts the driver who may have started to close his eyes." While the cost of the system is said to be three times that of conventional road markings, British police and highway officials have welcomed it as an extra aid to road safety.

ASPHALT AND LOW VOLUME ROADS

by Robert M. Willis
Engineering Staff Officer
Mark Twain National Forest

Many gravel roads reach a time when someone decides that an asphalt surface is necessary. There are many reasons for this decision, and often it centers around dust, volume of traffic, or a desire to improve the running surface. Often the asphalt is placed on the existing aggregate after grading. The new road will perform for a period of time and then begin to show distress. Usually this means large areas of cracking accompanied by base and subbase failure. It is time for another decision: Should the road remain asphalt or be returned to gravel?

This decision tends to be complex. Economics should be a big factor, and the cost of restoring the existing pavement may cost more than the original paving. Other factors are use, safety, and public input.

Removing asphalt can be done a variety of ways. Chip seal, road mix, and some

cold mix can be removed using a grader with scarifiers or rippers. All of the material has to be worked to get it down to a minimum size to leave on the road. Two inches is a typical requirement, but it could go up to three or four inches. Many asphalt roads can easily be restored to gravel, and the savings significant compared to the cost of maintaining pavement that does not have adequate base or subbase. In some cases, additional aggregate is required to stabilize soft areas that developed under the paving.

Repairing paving on roads with poor base preparation means strengthening the base. This requires removal of the asphalt, but the existing surfacing can be used along with additional aggregate to provide a good base. Of course, pulverizing is necessary, similar to the process used for removing surfacing. However, additional aggregate is required to improve the base and the existing base, addition base, and care with the base will substantially improve the performance of the paving and

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RAISING A MANHOLE LID

by Lawrence J. Curles, P.E.
City Engineer, Port Orchard, Washington

If road surfaces were level, raising manhole lids would be simple. Unfortunately, road surfaces are never level--making a chore out of what would appear a simple operation. An old town, with its old roads, has an infinite variety of geometric surfaces. And, no matter how hard you try, that lid will never raised in the right manner to fit into the existing surface of the street.

Port Orchard is trying to reduce stormwater infiltration into its sewer system. An obvious solution was to raise the existing manholes (which were depressed below the street surface) so that they would cease acting as storm drains. We tried a variety of methods.

Commercial manhole lid raisers did not fit our irregular road geometry. No matter what was tried, there was always one side of the lid that left a lip on the travel surface. We tried using asphalt to raise

and secure the lid. However, asphalt was not durable enough and rapidly cracked around the lid. Also, asphalt was not always available because the plants close during inclement weather--no rare occurrence in the Pacific Northwest.

Fortunately, the assistant superintendent of public works developed a simple and economical method to raise manhole lids, no matter what the condition of the road surface. The procedure requires only two men, a jack hammer, a piece of 18-by 80-in. sheet metal, two screw jacks, and a minimal amount of concrete. The procedure is as follows:

1. Using the jack hammer, cut the road surface away from the existing lid. Typically, the road surface would be cut 8 to 12 in. from the lid's frame.

2. Place the sheet metal into the manhole frame opening and shape the sheet metal in a circular configuration. The metal will serve as a concrete form. Use the two screw jacks inside the sheet metal to brace the metal and to get a good circular form that will not distort.

CONTINUED ON PAGE 9

MAINTENANCE TIPS

BRIDGE CURB AND RAILING REPAIR

Damage to bridge curb and railing could be the result of any accident or deterioration which decreases their effectiveness. Curb and railing damage may create a severe safety hazard, particularly if the railing is completely torn away. If not repaired, further deterioration may ultimately cause considerable damage and result in extensive repairs. The proper repair method for bridge curb and railing is shown below.

CREW REQUIRED:

Skilled laborers	2
Laborers	2
Flagmen	2

EQUIPMENT REQUIRED:

Tool truck	1
Flat dump truck	1
Portable concrete mixer or portable welder	1

MATERIAL REQUIRED:

Cement/sand/aggregate (as required)
Plywood
Metal hand rail (as required)

REPAIR PROCEDURE:

1. Place signs and other safety devices.
2. Remove damaged material and clean area.
3. If metal rail, weld new rail into position. If concrete, place forms. Install reinforcing steel and pour concrete. Cover with wet burlap.
4. Cure and remove forms. Rub concrete surface.
5. Clean up site and remove signs.

DECK REPAIR

Any damage to concrete bridge decks such as cracking, scaling or spalling of the concrete is referred to as deck damage. Damage to concrete bridge decks is caused by weathering, improper construction, lack of expansion joints, and/or inferior materials. Normally deck damage occurs in

new bridges within a year of construction, in bridges subject to extreme temperature change and freezing, or where de-icing chemicals are used.

Deck damage is not severe as long as it is limited to isolated areas. If large areas of the bridge deck show signs of damage, then the deck should be repaired as soon as weather permits to prevent further deterioration and to provide a good riding surface. Crack filling with asphalt is one technique for repairing bridge decks.

CREW REQUIRED:

Laborers	2
Flagmen	2
Truck driver	1

EQUIPMENT REQUIRED:

Asphalt kettle	1
Air compressor	1
Dump truck	1

MATERIAL REQUIRED:

Liquid asphalt
Sand

REPAIR PROCEDURE:

1. Place signs and other safety control devices.
2. Clean out crack with stiff broom and compressed air.
3. Fill crack with liquid asphalt using a pouring pot and a squeegee. Do not overfill and cause excess asphalt on surrounding pavement.
4. Sprinkle surface with dry sand to prevent pick-up by traffic.
5. Clean up area and remove signs.

BRIDGE TIMBER REPAIR

Damage to bridge timber is usually caused by weathering, and it appears in the form of rotting, splitting or cracking. Detecting and repairing the timber as soon as possible is essential to prevent further deterioration.

CREW REQUIRED:

Crane operator	1
Skilled Laborers	3
Laborers	1
Flagmen	2

EQUIPMENT REQUIRED:

Tool truck	1
Winch truck	1
Lumber truck	1
Truck crane	1
Portable generator	1

EQUIPMENT REQUIRED

Lumber

REPAIR PROCEDURE:

1. Place signs and other safety devices.
2. Remove deteriorated section.
3. Replace with new lumber.
4. Clean up area and remove signs.

WORKSHOPS

THE FOURTH INTERNATIONAL CONFERENCE ON LOW-VOLUME ROADS August 16-20, 1987 Ithaca, New York

Cornell University will host the Fourth International Conference on Low-Volume Roads on the campus in Ithaca, New York. The conference is sponsored and organized by the Transportation Research Board.

Approximately 250 local highway officials, particularly from county-level government, are expected to attend. It is anticipated that nearly every state in the U.S. will be represented, and visitors from twenty to thirty foreign countries will participate in the meeting. A total of about 77 papers are scheduled to be given on topics ranging from financing low-volume roads to roadway maintenance.

The conference registration fee will be \$100, and \$75 for companions. It is not necessary to be a member of the Transportation Research Board to attend the conference. If you would like to register for the conference, write to:

Fourth International Conference on Low-Volume Roads

Transportation Research Board
2101 Constitution Avenue, NW
Washington, DC 20418

or call the Cornell Local Roads Program at 607/255-8033.

The conference hotel will be the Ramada Inn in downtown Ithaca, and they have extended excellent rates for the meeting. Please get your reservations in as soon as possible.

TRAFFIC ENGINEERING

August 17-21, 1987
Atlanta, Georgia

This course in traffic engineering, sponsored by Georgia Tech's School of Civil Engineering, is designed to help those people responsible for traffic engineering learn more about the basis of their work. The five-day program's main emphasis is on general principles of traffic engineering.

The course will be taught by Georgia Tech faculty and experienced traffic engineering personnel. Questions about the program should be addressed to Dr. Donald O. Covault, School of Civil Engineering, Georgia Institute of Technology, Atlanta, GA 30332. Phone: 404/894-2235.

The course fee of \$650 includes all necessary classroom materials. Participants will earn 3.5 Continuing Education Units.

To register by telephone, please call 404/894-2400.

Be on the lookout for announcements on upcoming courses sponsored by the Technology Transfer Center. A workshop on Geotextiles will be held in late June. Also, our ever popular workshop on Microcomputers will be held at various locations around the state in mid-July.

CONTINUED FROM PAGE 1

The mowing attachment does not have its own brake, it is even more important to maintain a safe slow speed. A heavy rolling load that cannot be controlled by the tractor can jackknife. Remember that at transport speeds, you should pull only as much load as the tractor can control and handle safely.

Slow down while turning off a roadway. Sudden turns at high speeds can cause an overturn or other type of accident. Gravel makes the situation even more perilous, because the brakes can't grip the road. Sharp turns must be avoided at all times since they can cause the mowing attachments to jackknife, be picked up by the tractor wheel and be thrown against the operator.

Exercise extreme caution whenever you cross a highway or road. Be sure to assess the sight distance, weather conditions and gravel distance before crossing. Always get the traffic clear before crossing or turning onto a roadway. If you are below the crest of a hill or near a sharp turn that obstructs your sight distance, be particularly alert for unseen vehicles. Make sure you have enough time to cross.

If you are driving a 15-foot mower, the "wings" should be secured before traveling on the roadway. Always raise the wings before crossing a bridge.

Come to a complete stop at all railroad crossings and look both ways to make sure a train is not approaching. Do not cross the tracks at an angle, as the tractor tires could get wedged in the tracks.

Obey all traffic laws while driving on public roads. Signal your intention to turn, slow down or stop. Be sure your tractor and mowing attachment occupy no more than one lane. Stay well clear of any pedestrians.

Safe Operating Procedures

Because of the weight distribution of tractor-mounted mowing implements, there is a great risk of rear overturns when mowing on slopes. To avoid this, it is strongly suggested that front-end weights be added to the machine. Front weights offset the lifting action of the tractor front caused by the rear-mounted attachment.

When starting up a hill, engage the clutch gently. Popping the clutch can

cause the machine to tip over backward. If your equipment permits, back the tractor up the incline. If backing up is not possible, climb the hill at an angle. If the slope is steep, use a low gear to prevent the engine from stalling. If it does stall, set the brake immediately. Apply power gradually after restarting the engine or back down to level ground and use a lower gear.

The tractor chassis is built high off the ground so it can clear low obstacles. This means that the tractor has a high center of gravity and is somewhat top-heavy for use on slopes. Consequently, it has a dangerous tendency to overturn when driven sideways on steep slopes. If the tractor does start to tip, steer the front wheels downhill, not uphill. Turning downhill will quickly increase the tractor's stability and help prevent an overturn.

Keep the tractor in gear when going downhill and let the engine act as a brake to slow down the load. If the load brakes too much, open the throttle slightly. If the engine doesn't supply enough braking action, assist it by pressing on both brake pedals.

Never take the tractor out of gear when going downhill. A tractor that is not in gear runs a great risk of going out of control. Also, remember that it is safer to go downhill at an angle to the slope.

While mowing, be alert for other hazards and obstacles, such as rough ground and hidden culvert holes, that might cause the machine to overturn. If possible, check the area beforehand to locate natural obstacles like hidden rocks, tree stumps, low hanging branches and overgrown gullies. Take note of any man-made obstacles, such as signs, posts, fences and mailboxes, that might be in the path of the mower. Remember that at even relatively slow speeds, running over a hidden object can raise one side of the tractor and threaten its stability.

Be especially careful when moving around signs posted along the roadways. If you accidentally knock one down, report it to your supervisor to be sure that it is replaced.

When mowing with a rotary mower, always disengage the power take-off and lift the mower before reversing the tractor.

Driving too close to the edge of a

ditch or bank is another major cause of mower accidents. As a general guide, estimate the depth of the ditch and stay an equivalent distance from the edge.

In the event that the tractor wheels become stuck in a ditch or muddy area, do not place something under the front of the rear wheels to provide traction. Likewise, do not increase speed and engage the clutch quickly. Either of these practices can cause the front end of the tractor to rise and rotate around the rear axle, possibly causing injury to the operator.

If the tractor wheels become stuck, first try backing out. You may place a board behind the rear wheels to help provide traction. If this does not work, dig out an area in front of the rear wheels, shift into low gear, use moderate engine speed and engage the clutch slowly. It may also help to dig out the area in front of the front tires if they are not already on solid ground. If none of these procedures helps, it may be necessary to attach a tow line to the drawbar of the stuck tractor and pull it out with another tractor.

The bottom line in operating dangerous equipment is to safeguard yourself and others by using mature judgment. Follow all traffic and safety regulations. Remain alert and cautious while operating mowing equipment, and never use it for any purpose for which it was not intended.

Technology Exchange, Vol. 2, No. 1, Spring 1987. LSU Technology Transfer Program, Louisiana Transportation Research Center, Baton Rouge, LA. Excerpted from the LDOTD audio-visual course Basic Equipment Operation: Wheel Tractor and Mowing Machines.

CONTINUED FROM PAGE 5
("RAISING A MANHOLE LID, SIMPLY")

3. Position the top of the sheet metal as necessary to get the correct lid elevation.

4. Once the sheet metal form is in place, concrete is put in the excavated area. On this concrete and over the form, place the manhole frame. Enough concrete should have been prepositioned so that the frame is about 1/2-in. higher than the desired elevation. The frame is then

tapped into place and more concrete is poured in the excavated area around the lid. The lid is placed on the frame when the concrete has set enough to support the extra weight. The frame has been raised and the time consuming effort of placing blocks under the frame has been eliminated.

Typically, you will only need 3 to 5 cu. ft. of concrete per manhole. We have discovered that a concrete batch plant will sell this small amount at a reasonable price if you pick it up at the plant. The city uses an old 55-gal. barrel in a pickup truck to get its concrete. The concrete can then be trowled to conform with whatever irregular surface the road may present.

In this manner, two unskilled employees can rapidly raise a manhole lid and provide a durable product. The concrete should set for two days and will resist all the punishment that the road and the environment can deliver.

Oregon Roads Newsletter, Oregon Technology Transfer Center, Salem, OR. Reprinted from Public Works, August, 1986.

CONTINUED FROM PAGE 5

("ASPHALT AND LOW VOLUME ROADS")

improve its life. In most cases, all of the paving does not have to be ripped. Only those sections that show distress and large areas of base failure need to be treated. This distress is often associated with clay areas in the subbase, and may not be evident when the road is gravel. These clay areas have a tendency to hold moisture under paving.

Repairing a section that has been paved with hot mix is more of a problem. Removal of the asphalt will be more difficult. It will usually require a dozer with a ripper and must be reworked with special equipment to get to a size that can be used as a base. With massive base failures, it may be less expensive to remove the hot mix for recycling and add aggregate to the base. In all cases, the quality of the base is critical to the life and stability of the paving. The effort taken with adequate base depth and compaction saves many future dollars.

Missouri Transportation Bulletin, Vol. 4, No. 1, March 1987.

PUBLICATIONS

Limited copies of the following publications are available at no cost from the Technology Transfer Center. Requests may be made by writing or telephoning the Center.

Films for Highway Safety and Traffic Engineers, Report No. FHWA-IP-86-25

by Office of Implementation

This technology sharing report contains a catalog of audiovisual aids of potential interest to highway safety and traffic engineers. Special efforts have been taken to make it easy for a user to learn of available audiovisual aids by subjects. Each description contains an abstract, source, cost information, and key subject words.

Guide to Management of Roadside Trees, Report No. FHWA-IP-86-17

by Office of Implementation

This Guide describes a procedure for investigating and analyzing roadside trees which considers safety, economic, and environmental aspects in prioritizing accident countermeasure alternatives.

State and Local Highway Training and Technology Resources

by National Highway Institute

This Directory contains information on subject matter, location price and, availability of highway training and technology resources available to the Rural Technical Assistance Program sponsored T2 Centers. The Directory will be supplemented with additional data periodically. Material is appropriate for local roads government agencies serving populations of 50,000 or less.

The following are brief descriptions of selected items that have been completed recently by State and Federal highway units in cooperation with the Office of Implemen-

tation, Offices of Research, Development, and Technology (RD&T), Federal Highway Administration. Some items are of special interest to highway agencies.

When ordering from the National Technical Information Service (NTIS), use PB number and/or report number with the report title and address requests to:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Asphalt Pavement Rutting—Western States, Report No. FHWA-TS-84-211

by Office of Implementation

A series of workshops were conducted in late 1983 to develop a set of guidelines to assist the Western Association of State Highway and Transportation Officials (WASHTO) States in preventing or reducing rutting in asphalt pavements. Representatives from most of the WASHTO States participated and provided input. It was agreed that because so many variables contributed to asphalt rutting, it is unlikely that a single cause or solution could be identified. Nevertheless, it was the consensus of the States that the highest short-term payoffs could be achieved by improving and strengthening State procedures in mixture design, materials, and construction practices. Recommendations for aggregate acceptance, paving asphalt cements, mixture design criteria, compaction control, traffic data, and information exchange were developed. In general, it was felt that rutting could be prevented or reduced if most or all of the recommendations were adopted. This report reflects the discussions at the workshops and summarizes the recommendations.

The report may be purchased from NTIS (PB No. 86 156460).

Recessed Reflective Markers Feasibility Study, Report No. FHWA-TS-86-207

by Office of Implementation

Conventional glass bead traffic stripes generally provide poor delineation under wet-night conditions. Many States,

OREGON DOT SENDS BILLS TO ACCIDENT CAUSING DRIVERS

Drivers have paid a record \$826,000 or accident damage to Oregon's highways so far this year.

Repairs are not covered by tax dollars, so the Oregon Highway Division billed the 436 drivers at fault, according to Cindy Carter, Assistant Attorney General for the Division.

"If you went out and injured someone else's property, you would expect to pay for it. It's no different with state property," Carter says. The typical items the highway division can bill a driver for include damage to guardrails, signs, bridges, the road surface, cleaning up a truck spill, or providing traffic control.

"If you are involved in an automobile accident and you fail to pay for the damages that result, stiff penalties are imposed," Carter says. "The highway division will contact the Motor Vehicles Division, and they will suspend your driver's license and the registration of any vehicles in your name until the claim is paid."

This means the loss of driving privileges for individuals, Carter says. Trucking companies can have their entire fleet sidelined for failure to pay. With that kind of incentive, it's no surprise that the highway division collects in 95% of the cases.

Passenger cars were billed for damages in 56% of the cases, and commercial vehicles drivers were billed in 44% of the cases. Claims abandoned by the division as non-collectable total \$42,360 so far this year.

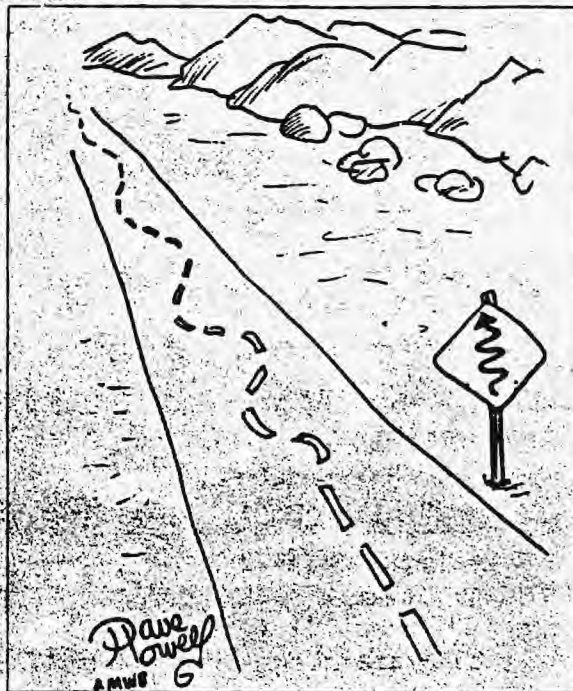
EXPERIENCE IS WHAT YOU GET WHEN YOU DIDN'T
GET WHAT YOU WANTED.

ACKNOWLEDGEMENT

The Technology Transfer (T2) Program is a nationwide effort financed jointly by the Federal Highway Administration and individual State Departments of Transportation. Its purpose is to translate into understandable terms the latest state-of-art technologies in the areas of roads, bridges, and public transportation, to local and county highway and transportation personnel.

The T2 Center at Georgia Tech is sponsored by the Georgia Department of Transportation and provides information and counsel to more than 500 municipalities and counties in our state. This newsletter is designed to keep you informed about new publications, new techniques, and new training opportunities that may be helpful to you and your community. Individuals wishing to receive future copies of this newsletter at no cost may send their requests to:

M. John Moskaluk
Technology Transfer Center
School of Civil Engineering
Georgia Tech
Atlanta, GA 30332



especially in the north, have complemented the stripes with reflectors positioned adjacent to or in line with the normal striping. Reflectors, placed in recessed grooves, have shown low susceptibility to damage from snowplows.

Manually installing reflectors after the pavement has been placed requires cutting the pavement to provide the groove. Approximately 45 percent of the installation cost is for the diamond cutting blades required to cut the pavement. This report documents the results of an FHWA study that tested and evaluated candidate systems for forming the grooves during paving operations. Recommendations are included for field testing and additional research needs.

The report may be purchased from NTIS (PB No. 86 164696).

Longitudinal Edge Drains in Rigid Pavement Systems, Report No. FHWA-TS-86-208

by Office of Implementation

This report documents the findings of a four-State study of longitudinal edge drain systems used in rigid pavements. Design philosophies and criteria, construction practices, and field performance comparisons are discussed, as well as where edge drains may not be advisable.

Trench drains and drainable asphalt concrete layers were found to be cost-effective in terms of their original cost and in their ability to remove water. Performance comparisons with 7-year-old pavements without drainage provisions indicate that edge drains can extend pavement life. Maintenance of the edge drain system contributed to pavement performance.

The report may be purchased from NTIS (PB No. 86 168317).

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VOL 5 NO. 4

FALL 1987

PROBLEMS WITH PAVEMENT CUTS?

Maintaining a smooth riding surface of local roads and streets is becoming increasingly difficult. This is, in part, due to utility employees or contractors making street cuts that are not being properly restored due to insufficient control. Therefore, it is extremely important that any local governing body, large or small, develop and enforce ordinances for use of its right-of-way by utilities.

The ordinance that you develop must be explicit and uniformly applied to municipal agencies as well as contractors. Items which should be included in a good ordinance are:

BONDS—Amount should be based upon the potential for road damage. It should remain in effect for two years to ensure proper restoration of the road.

PERMITS—All work conducted in your right-of-way should require a permit prior to construction. Plans should be required with each request involving a street cut or utility installation. Fees can be based upon the project size or a flat fee may be assessed. Any paper work processing needs time. The utility company must know what advanced notice is expected to your agency prior to construction and what specifications they are to meet. Identify emergency-cut procedures and outline suitable traffic-control procedures.

SPECIFICATIONS—Develop specifications. Use PennDOT's Regulations Chapter 203—Work Zone Traffic Control and Chapter 459—Utility Occupancy. The specifications should outline requirements for pavement cutting, type of material to be used for backfill, minimum compaction standards, restoration of sub-base, flexible base, wearing course standards, and paint and identification.

INSPECTIONS—Restoration will be no better than the inspection effort made. The specifications must be followed. A clause should be in the permit declaring that the utility owner is ultimately responsible for adherence to local specifications. A good policy is to require notification 24 to 48 hours prior to actual work. Follow-up inspections should be made 6 to 24 months after the repair. All inspections should be documented.

PENALTIES FOR NONCOMPLIANCE—Set a target date for compliance. If work is not completed satisfactorily, make the necessary repairs and bill the utility. If they do not pay for the repair, the performance bond is available for this purpose.

POTENTIAL PROBLEM AREAS—When the utility requesting/making cuts is owned by your governments, discretion must be used in deciding if a permit is required, how to enforce your city's specifications, and who will do inspections.

Compacted backfill, the road-base structure, is the most important element. Visual checking cannot verify the density. Density tests by an independent firm should be a routine check, the cost to be paid by the contractor.

Traffic control in some cases is inadequately addressed. During this permitting phase, be sure to review the applicant's plans.

Inspection and documentation of work could be the single most important part of effective patch repair. Be sure you have a qualified person to monitor the restoration of the road.

Do you have so many patches that you don't know which one is whose? Assign color codes for utilities and have them paint colors on curb or patch to identify responsibility for failure.

SUGGESTIONS

- Get to know your utility construction people and develop a good rapport.

Continued on page 2

Continued from page 1

- Set up or attend preconstruction meetings between contractors, utility companies, and local officials to resolve difficulties and to plan future construction.
- Drilling, boring, driving, or tunnelling should be enforced in lieu of open-cutting where conditions permit.
- Plan ahead. Make a list of roads to be resurface within the next year and provide to utilities companies. This could encourage them to do work in that area before it is repaved.
- Casing or encasement should be required, where practical, to avoid reopening of the highway surface for future repairs.

TEMPORARY PAVEMENT MARKINGS

Recent studies evaluated both temporary day-night visible raised pavement marker adequacy and marking patterns in work zones.

The first study was reported by Thomas D. Davis, Bureau of Transportation Systems Research, Division of Research and demonstration, New Jersey Department of Transportation, at a Transportation Research Board meeting. The study was conducted to help find temporary markers that can withstand construction zone traffic.

Two systems met the needed requirements, Davis says—a hollow acrylic marker with a sealed prismatic air cell reflector, such as Amerace's Stimsonite 66B, or a combination of a dome-shaped polyester marker, such as Traffic Safety Supply's Titan TM-40 for day visibility and a filled ABS shell marker with cube-corner reflex reflector, such as I.T.L.'s Ray-o-Lite or its equivalent for night visibility.

The accompanying tables summarize the results of the visibility and durability tests applied to six candidate markers. The Ferro P-15 ceramic marker was the control used in the experiment, Davis says, and the recommended system should equal or surpass the ceramic's visibility and exceed the ceramic's durability.

In the first table, eight observers made independent decisions on the distance from which they could detect each array under various light conditions, and with asphalt and concrete pavements (two observations each). The 16 observations were averaged.

After six months, the markers were removed. Unfortunately, the Stimsonite markers came off in fragments and had to be fitted together again. This no doubt lowered the visibility results.

The most desirable features in a day-night construction zone marker were:

- * A streamlined profile.
- * A microscopic cube-corner, sealed prismatic air cell, cube-corner reflex, or multiple-glass lens reflector.
- * A balance between the reflector and casing area exposed to the driver.

Further research is needed to find an adhesive better than the butyl pad for temporary markers, Davis says. The butyl requires a primer that must be allowed to dry, and a vehicle must then be driven over the marker. In practice, these steps may not be followed and the marker may fall off the pavement. There are also problems with cold, rough pavement, and incompatibility with some markers.

Hot-melt adhesives should be investigated. In comparison to butyl, they:

- * Require no primer.
- * Conform to pavement irregularities.
- * Work in a wide range of temperatures.

Marking Patterns

Temporary pavement marking patterns in work zones were studied at the Texas Transportation Institute, Texas A&M University, and reported at the same TRB meeting by Conrad L. Dudek, R. Dale Huchingson, and Donald L. Woods.

The objective of the study was to investigate 10 candidate temporary marking treatments—one base treatment consisting of 4-ft. stripes with 36-ft. gaps, and nine other treatments using variations in stripe length, gap length, and reflective and nonreflective raised pavement markers. Daytime studies were conducted first; then the best six daytime studies.

A number of significant points resulted from the daytime studies. Drivers rated the 1- and 2-ft. stripes with gaps of 38 ft. or more as the least effective among the striping patterns tested. Treatments with 1-ft.-long stripes and 48- and 38-ft. gaps were found to have the greatest number of erratic maneuvers. Treatments using reflective pavement markers were preferred.

In general, nighttime studies supported the findings of the daytime studies which found that 8-ft. stripes with 32-ft. gaps were the most effective in terms of driver preference when reflective pavement markers were not used. Drivers found treatments using reflective pavement markers highly effective.

All reflective pavement marker systems were substantially preferable to the control treatment—4-ft. stripes with 36-ft. gaps. But, no single RPM treatment was deemed best.

Better Roads, August 1987.

MAINTENANCE TIPS

ABUTMENT REPAIR

Abutment repair is needed when cracks occur at abutments, endwalls, wingwalls, and/or retaining walls. These cracks are the result of base settlement, improper construction techniques, and/or weather deterioration. They are found in bridges with heavy loads or within a year after construction of a new structure.

Abutment cracking is not a severe problem when it is properly repaired and maintained. If not repaired, structural failure may occur, forcing closure of the bridge and extensive structural repairs. The repair method is outlined below.

CREW REQUIRED

Skilled laborers	2
Laborers	3
Flagmen	2

EQUIPMENT REQUIRED

Tool truck	1
Dump truck	1
Portable concrete mixer	1
Air compressor	1

MATERIAL REQUIRED

Cement/sand/aggregate
Lumber

REPAIR PROCEDURE

1. Place signs and other safety devices.
2. Remove material from around section to be repaired.
3. Apply bonding agent (neet cement can be used).
4. Replace deteriorated section with concrete.
5. Cure and rub new concrete.
6. Clean up area and remove signs.

STRUCTURAL PAINTING

Structural painting is needed when there is bridge deterioration due to lack of painting or general roughness due to vandalism.

Structural members of bridges should be painted every 5-6 years to prevent deterioration and ultimate structural failure. Intermittent painting may be needed to correct damage caused by vandalism.

While lack of painting over periods exceeding 8 years may create a deficiency, damage by vandalism does not lead to a sever deficiency.

The proper method of painting bridge structures is described below.

CREW REQUIRED

Sandblast operator	1
Painters	2
Laborers	2
Flagmen	2

EQUIPMENT REQUIRED

Stake truck	1
Dump truck	1
Air compressor	1
Sandblaster	1
Paint sprayers	1

MATERIAL REQUIRED

Sand
Paint

REPAIR PROCEDURE

1. Place signs and other safety devices.
2. Position scaffold.
3. Sandblast only area that can be primed on same day.
4. Apply primer.
5. Allow drying time. Apply finish coat.
6. Remove scaffold and clean up.



DEFERRED MAINTENANCE AND REHABILITATION

by Mathew J. Betz

As budgets tighten in many cities and counties, discussions of whether or not to defer maintenance and rehabilitation of streets and highways have become more heated.

In addition to budgetary constraints, other factors may require postponing maintenance activities. Especially in small jurisdictions, these are normally unforeseen or unusual environmental conditions. Heavy floods that severely damage drainage facilities or unusually heavy snowfalls are two environmental examples. Nonenvironmental examples could include major incidents such as the collapse or closing of a bridge or an unusually devastating accident.

Although cost consequences on a specific road are difficult to determine, there is a growing body of information about the economic and technical consequences of deferring major maintenance activities, especially those related to surface maintenance.

While discussions regarding maintenance deferral often imply that an optimal schedule for routine and periodic maintenance exists for each road in a jurisdiction, this is never the case. For most rural jurisdictions, the maintenance schedule resides in the experience of maintenance supervisors and their knowledge of current street and highway conditions.

A few jurisdictions are beginning to implement maintenance management systems and pavement management systems that provide them with a more formal schedule of activities. But as anyone who has

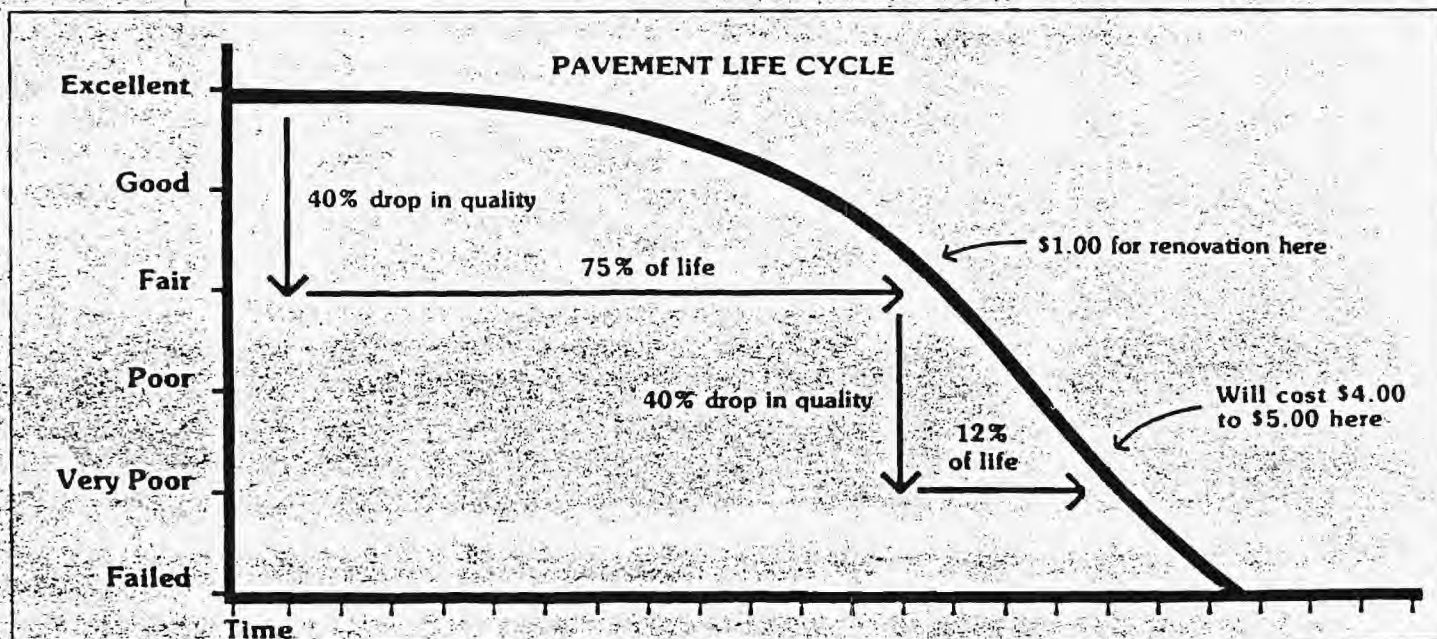
worked with these systems knows, the output is not perfect.

What Can Be Deferred and How Long

A wide variety of routine and periodic road maintenance activities can be deferred for varying periods of time without incurring undue costs. Since little has been written regarding the costs and benefits of deferring maintenance activities, maintenance supervisors' perceptions regarding the desirability of maintenance deferral vary according to their attitude and experience.

One of the maintenance functions that is least susceptible to deferral is the maintenance of drainage facilities. For example, if the maintenance schedule calls for drains to be cleaned and maintained at the beginning of the dry season, this activity can be postponed until just prior to the rainy season. However, it would be very costly and dangerous to postpone the repair and cleaning of drainage facilities into a rainy season. Damage could be done, not only to the drainage structure but to the entire roadway system, if there are failures in the surface or subsurface drainage. In addition, a washout or similar incident could make the road unusable for extended period of time, causing great economic loss and social disruption.

Patching, especially on paved roads, is another routine maintenance activity which probably should not be deferred. Failure to repair potholes promptly causes at least three very important results. Probably the first to come to the attention of the maintenance supervisor is an increase in the number of complaints by road users. The second and equally important result is that potholes left unrepaired may lead to continued and increasingly rapid disintegration of the surface. The third is that potholes may be a contributing factor to an increase in accidents



leading to property damage, injury or even fatalities.

Some activities that are deferrable for relatively indefinite periods of time include roadside litter pickup, mowing and other activities such as the restriping of paved roads. Striping can be postponed in some environments for up to a year or more. However, restriping cannot be postponed indefinitely without endangering the public and exposing the jurisdiction to civil suits.

What is normally postponed when budgets become extremely limited? In many cases periodic maintenance is considered more easily deferred than routine maintenance. This is especially true of periodic surface maintenance of paved roads, such as resealing or some other surface improvement. These functions traditionally have occurred on a long-term basis, once every five, eight or more years. Thus, there is a general feeling that if the road has been satisfactory for the past five years, it will go another year or two years without adverse results.

Paved Road Deterioration Rates

Research indicates that although initial surface deterioration on lightly paved roads is relatively slow, distress accumulates, and the rate of deterioration accelerates. The following figure is typical of the paved road function being used today by many jurisdictions in their pavement management systems. The figure shows that there is little deterioration during much of the life of the roadway but that nearer the end of its physical life, deterioration accelerates. The figure does not indicate a specific number of years for the life of the roadway. The actual life will be a function of four sometimes complex and highly interrelated sets of factors. These are the initial design and construction of the roadway; the loads, both number and weight, being applied each year; the local environmental conditions; and the frequency and type of maintenance. Inadequate designs, heavy loads, adverse environments (such as heavy freeze-thaw or poor drainage) all act to decrease the life of paved surfaces. This is especially true for lightweight pavements such as chip seals (bituminous surface treatment) or similar paving.

As illustrated in the figure, a relatively small amount of deterioration occurs in the first 75 percent of the pavement's life. Assuming that chip seals have a life of nine to ten years (which is probably optimistic in some Arizona locations), then the impact of this rapid deterioration near the end of a pavement's life can be quantified and becomes very dramatic.

For a chip seal pavement with an estimated nine-year life, it will take almost seven years for the pavement to deteriorate from excellent to fair condition. If budgets are tight for the following

year, it is natural to look at that roadway, think of the past seven years' deterioration rate and make a judgment to defer the rehabilitation of the roadway. Such a decision can be disastrous, both in terms of the physical condition of the roadway and the financial consequences for the jurisdiction. The figure would indicate that in the next 12 percent of the pavement's life, which in this case is only one year, the road will deteriorate from a fair to a very poor condition. At this point, what would have cost \$1,000 to rehabilitate to an almost new condition the year before will now cost \$4,000 to \$5,000.

Looking at those costs in another way, the first seven years of life incurred an average annual cost to rehabilitate of approximately \$150 (\$1,000 divided by 6.75 years, which is 75 percent of a nine-year life). Deferring rehabilitation beyond that critical point could cost an additional \$3,000 to \$4,000 for one year.

Many readers may argue with these figures, and the documentation of this curve for all types of lightly paved roads is not complete. Nevertheless, as experience accumulates in developing information of this nature, it is clear that the cost of deferring surface rehabilitation increases as roads age. These costs increase rapidly each year rehabilitation is postponed until finally the road fails.

Although there is less documentation regarding the deterioration of gravel and aggregate roads, they appear to be less susceptible to the accelerating rate of deterioration than paved roads. Also, the cost to rehabilitate gravel roads may be much closer to a linear function of accumulated traffic volume and time. In other words, deferring maintenance on aggregate roads is less likely to result in disproportionate rehabilitation costs over the short run, i.e., a year or two. This is not to say that the costs for rehabilitation will not increase, because they will, but they are less likely to increase rapidly. Specifically, if it has taken four years for an aggregate road to deteriorate to a condition that would normally lead to regravelling or other rehabilitation, and the estimated cost is \$1,000 per unit, then a postponement of a year might increase the cost to about \$1,300.

Strategy

Based on the preceding and the uncertainty of budgets in many local jurisdictions, one may wish to adopt a more conservative strategy for the rehabilitation of paved roadway surfaces. If "fair" surface condition is identified as the optimal point for surface rehabilitation, then a more conservative strategy would argue for a periodic maintenance involving surface rehabilitation at an earlier time. This would not minimize total costs if budgets were assured, but it would provide a buffer so that pavement rehabilitation could be deferred in a tight

Continued on page 8

Continued from page 5

budget year (or even two) without adverse pavement deterioration and the accumulation of added costs to the community.

Applying the specific strategies would involve determining the probability of tight budgets, their timing and duration. A risk analysis using such estimations can identify a strategy to provide for both technical and budgetary flexibility, as well as minimum costs over the long term.

Arizona Roads, July 1987.

NEWS BRIEFS

o Do you know what roadside obstacle is hit most often? Fences are the number one roadside obstacle. When the vertical support posts are hit and forced down, the upper horizontal rail slips out of the rail splice sleeve, spearing the oncoming vehicle. A low cost solution is simply to leave the expensive top rail out of the installation. The fence will stand up but the danger is reduced, saving both lives and money.

o The Federal Highway Administration had a contract with a subsidiary of Kodak to develop a crack detecting device for network surveys of roads. The goal is an affordable tool (\$50,000) that State highway agencies can use to perform an automatic condition survey of the statewide network. The Kodak subsidiary, Ektron of Bedford, Massachusetts, is designing the device to fit in any normal size van. It will operate at highway speeds under normal daytime conditions.

The device is based on the principle that much less light is reflected from a pavement crack than from a continuous pavement. The dark area can be sensed and the magnitude of light recorded. Ektron has developed an instantaneous light meter to do this. It will be connected to a computer and printer so a recording of the pavement cracks can be tabulated. The FHWA is optimistic that a usable device will be developed by next fall. It will then be made available for evaluation by interested State highway agencies under the FHWA implementation program.

o Charles J. Funnye, Commissioner of Public Works for the City of Atlanta, was selected by the American Public Works Association at one of this year's Top Ten Leaders in Public Works. He was

selected for his initiation and design of Atlanta's Three Rivers Water Quality Program. Funnye's plan consolidated wastewater plant discharges from two streams to a major river, producing a major treatment cost reduction.

o There is a microcomputer users' group called "TIME" consisting of public transportation professionals interested in exchanging experiences, ideas and software with similar microcomputer users. Membership is open to the public at no charge and includes regular receipt of TIME CAPSULE. To join, write the TIME Support Center, Department of Civil Engineering, Rensselaer Polytechnic Institute, Troy, NY 12180-3590.

o An experiment conducted at three sites in Britain by the Transport and Road Research Laboratory has determined that flashing warning signs, triggered when vehicles follow too closely, can help decrease rear-end collisions. In the three sites chosen, the experiment involved a blank sign which turns into a flashing message when gaps between passing vehicles fall below a predetermined level. The two signs evaluated were of similar appearance to the dot matrix signs used on main highways.

Results of the experiments showed a clear effect of the signs on driver behavior—specifically, a reduction of about one third in the number of drivers following less than one second apart at the first monitoring site, spaced 400 to 500 meters after the sign. An effect was still apparent, though slightly diminished at the second and subsequent monitors, up to 1,900 meters from the sign.

o The National Committee on Uniform Traffic Control Devices continues its efforts to assist in the development of standards, guides, and warrants for traffic control devices. Recent signs of progress include the Federal Highway Administration's adoption of 18 changes to the Manual on Uniform Traffic Control Devices (MUTCD). Also, the U.S. Government Printing Office has distributed revision #4 to the 1978 MUTCD. Other committee actions include preparation of a detailed reply to FHWA's request for comments on standards for performance of retroreflective traffic control devices and of the need for a new MUTCD without such conditions as "should" and "may."

VIDEO TAPE LIBRARY

The Technology Transfer Center has added five new tapes to its video tape library since the last listing. The tapes may be borrowed, at no charge, for a two week period. Please write or phone and request no more than two tapes at a time. Specify the tapes you want by the number in the left hand column.

- DC-203** *Operating Tips: Push-Pull Scrapers*
(12 minutes)
Discusses cut and fill operations for pairs of scrapers.
- Operating Tips: Off-Highway Trucks*
(17 minutes)
Discusses inspection, start-up procedure and off-road operations.
- Operating Tips: Track-Type Tractors*
(15 minutes)
Considerations for safe and efficient operation including inspection, dozing, land clearing, ripping and push loading scrapers.
- Loading Logic* (17 minutes)
Efficient choice and use of loaders and trucks for hauling soil.
- Operating Tips, Wheel-Tractor Scrapers*
(18 minutes)
Discusses inspection, start-up procedure and operating techniques.
- Operating Tips: Track-Type Loaders*
(10 minutes)
Discusses inspection, start-up procedure and excavation for a variety of cases.
- Operating Tips: Wheel Loaders*
(10 minutes)
Discusses inspection, start-up procedure and operation.

- DC-215** *Design of Urban Streets - Part II*
Street Design Elements - Part 2
(30 minutes)
Describes cross-sectional design and horizontal alignment design.
- Street Design Elements - Part 3*
(30 minutes)
Describes vertical alignment design, design of vertical curves, drainage design and design for access control.
- Intersection Design Elements* (30 minutes)
Describes the basic intersection types, types of channelization, corner design pedestrian movement, vehicular movement and turning movements.
- Intersection Design Elements (Continued)*
(30 minutes)

Describes intersection control, problem identification and improvement techniques for problem areas. It also describes some type of urban and freeway techniques.

- DC-216** *Design of Urban Streets - Part III*
Traffic Signal Design and Operation
(30 minutes)
Basic principles of signals, advantages, disadvantages, the various types of signals and operations of different traffic signals.
- Illumination, Signs and Markings*
(30 minutes)
Advantages of lighting arterial streets, types of lights and elements considered in designing lighting systems, importance of signs and markings in street design and uniformity of signs and markings.
- Pedestrians, Bicycles and Transit Considerations* (30 minutes)
Discusses the integration and design of pedestrian, bicycle and transit facilities into the urban street plan.
- Factors Impacting Street Design*
(30 minutes)
Special factors which affect the design of urban streets.

- DC-217** *Design of Urban Streets - Part IV*
Social and Economic Impacts (30 minutes)
Social and economic impacts by the upgrading or design of new urban roadway facilities.
- Environmental Consideration* (30 minutes)
Environmental impact caused by urban street design. Emphasis on air and noise pollution.
- Project Documentation* (30 minutes)
Evaluation techniques for comparing design alternatives and selections.
- Administration and Management*
(30 minutes)
Consultant selections, bid procedures, contractor prequalifications, supervision of work and legal aspects of the design and designer.

- DC-218** *Asphalt Paving Inspection* (28 minutes)
Discusses sampling of aggregate, storage, cold feed, mixing plant and plant inspection.
- Pothole Repair* (12 minutes)
Demonstrates traffic control during repair, marking, cleaning, filling and cleanup.

OUR OWN FLEET MANAGEMENT PACKAGE

by William Moscan, Project Manager
Transportation Energy Management Program
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Although there are many computerized fleet management systems available commercially, we developed our own. Why did we bother to spend the time and money?

Several reasons indicated that most computerized fleet management packages are not appropriate for municipal applications.

The most important reason involves flexibility. Many fleet management systems are "canned" packages that cannot be altered or enhanced to meet user needs. As a result, the municipality is forced to change the way it operates to fit the package's requirements. The other option is to retain a software developer to make the necessary changes—a costly, time-consuming approach.

When we developed our Municipal Fleet Management Information System (MFMS), we made flexibility requirements part of our design objectives. We felt that a municipal fleet management system should be flexible enough to:

- Handle a wide variety of fleet sizes;
- Handle a mixture of vehicle and equipment types;
- Allow internal programming changes to suit different municipal modes of operation.

Another reason for developing our own system relates to the fact that most existing fleet management systems are designed to manage trucking fleets. This means that the system is intended for use on three to five different vehicle and equipment types. A municipal public works fleet can have up to 100 different vehicle and equipment types. MFMS can monitor virtually all combinations of vehicles and equipment. Based in Sudbury, the system covers our entire fleet including chainsaws, lawnmowers, graders, 10-ton dump-trucks, and heavy-duty snow-plows. The system also monitors fleets used for transit, parks and recreation, libraries, and the fire department. The fire department even monitors light bulbs in its stations.

User-friendliness of existing systems was also a factor in our development of MFMS. Many fleet management packages are difficult to operate, require multiple data entry, and most importantly, cannot be improved or altered to alleviate these shortcomings. MFMS was designed with the user in mind. We knew that the principal users of the software would be shop floor people, mechanics, and fleet managers—people who know very little about computers and their applications. MFMS enables these

people to operate the system with relative ease. The system is menu-driven, which means that there is always a list of options to select from. MFMS workscreens contain operating commands which, once selected, perform the work you request. On-line help screens describe data-entry formats and specifics about required information. The system also prompts correct data entry formats automatically while users input data. To enhance user-friendliness further, we are incorporating system codes that appear on the screen for quick reference. We also have a good set of system documents including user manual, implementation guide, production manual, and a two-volume systems manual.

From a municipal perspective, the most important reason for developing our own fleet management system was cost. Many existing software packages hit purchasers three times in the pocketbook. The software costs money; system enhancements and consulting services for implementation are expensive; and minicomputer hardware configurations or more are required. To combat these costs, we offer our system free to Ontario municipalities. We also supply complete system documentation, some preliminary implementation assistance, and ongoing support.

To train staff, Ontario's Ministry of Colleges and Universities offers a training grant of up to 50%. Municipalities wishing to make major changes to the system can do them in-house or employ a consultant. Those choosing to hire a consultant should expect fees ranging from \$5,000 to \$15,000, depending on the number and type of changes. However, it should be noted that there are many variations to MFMS and as the number of users increases, so will the number of variations. Eventually, new users will be able to select features that suit their needs from existing systems, minimizing enhancement costs.

We have also cut costs in hardware. As noted above, most commercially-available fleet management systems require at least a minicomputer. MFMS takes advantage of the improved memory capability of microcomputers. The system runs in a stand-alone micro format, saving money in both computing and hardware costs. System hardware requirements are estimated to cost between \$3,000 and \$13,000.

A fleet management system must perform two key functions: minimize fleet costs and maximize vehicle availability. MFMS minimizes fleet costs by cutting down maintenance and breakdowns and, through careful monitoring, maximizing fuel efficiency, vehicle life, and engine life. MFMS also manages shop floor efficiency, labor efficiency and parts inventory. In each case, standards are set and incorporated into the software program. If these standards are not met or are exceeded, the system flags them automatically. These failed standards are compiled into reports which can be produced on demand or on a regularly scheduled basis. This

porting system is designed to make information available to the fleet manager so that he or she does not have to go looking for it, thus saving time and money and minimizing errors and oversights.

Vehicle availability is also addressed by MFMIS. The system maximizes vehicle availability and use by running a coordinated maintenance program, ensuring availability of parts, mechanics, and bays. Again, standards are used to evaluate these items and monitoring is performed with on-line reports or hard-copy reports.

Based on a paper presented at the 1986 Canadian Public Works Conference and Equipment Show. APWA Reporter, March 1987.

WHY DID IT HAPPEN TO ME?

by Harvey Kuester

It is a human trait for anyone who has had an accident to ask "why did it happen to me?" There are probably two reasons why an individual will ask such a question: (1) to feel sorry for himself and to seek sympathy from others, or (2) to objectively analyze what happened and try to determine what could have been done differently to prevent the accident.

There is nothing wrong with either reason. We need sympathy and reassurance, but when we stop at that point, there is a tendency to place the blame on another person or charge it to fate. Objectively analyzing the factors which lead up to the accident is more rewarding in the long run because it can help us avoid getting into another accident.

If the accident was vehicular, we might ask ourselves some of the following questions:

1. Was the vehicle or equipment I was operating in good mechanical and physical condition?

2. Was I practicing good defensive driving techniques?

3. Did I react to the situation in the best possible manner?

4. Was I wearing the safety belts which were provided?

On the other hand, we might ask ourselves the same questions if it was a nonvehicular accident?

5. Was I wearing the proper personal protective equipment?

2. Was I using the right tools for the work I was doing?
3. Was I wearing the proper attire for the work I was engaged in?
4. Was I following the accepted safe standards for the work I was performing?

When we ask ourselves these questions, we are performing our own accident investigation.

While we can all benefit from accident investigation, all of us will agree that preventing an accident is the best approach. Job training, protective equipment, teamwork, a cooperative, inquiring attitude, and discussing the safety aspects of our work at safety meetings are some of the accident prevention tools which are available.

Accident prevention then, is the key to avoiding accidents. If we keep this in mind during the course of our work and other daily activities, we can substantially reduce need for sympathy and accident analysis. We can instead say, "it doesn't have to happen to me." In addition, we can be proud of our ability to perform work safely and efficiently without our work environment.

Rural Transportation Technology, Vol. 2, No. 2, Spring 1987.

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GETTING WHAT YOU PAY FOR

An often neglected area in municipal maintenance is quality control or getting what you pay for. It may not seem important at the time, an unnecessary expense or an annoyance, but you either pay now or pay later. Quality control begins with four basic questions.

1. What do you want?
2. How do you order it?
3. Did you get what you ordered?
4. What do you do if you do not get what you wanted?

The first question is very important because the proper techniques used at the proper time can really stretch your budget. For instance, a pavement management program that you can develop by using a computer or by hand can assure the quality you want.

How you order and assure maintenance quality is by using the proper specifications—specify exactly what you want and order exactly what you want. A variety of standard specifications are already written and available from American Society of Civil Engineers (ASCE), American Association of State Highway and Transportation Officials (AASHTO),

National Association of County Engineers (NACE), and from other transportation-related agencies.

Did you get what you specified? The best answer may be to have a qualified inspector supervise the work. Many municipalities rely on their road superintendents or road-crews to conduct the necessary inspections. Although these individuals are usually versed in the lore of roadwork, many processes such as seal coats are not as simple as they appear. It is difficult for individuals who do not have specialized training to inspect seal coats. The inspector's job is to monitor the worksite, take samples of job materials for lab testing, and record the progress of the project. They must also check to see that the proper equipment is used and that it is calibrated properly.

What do you do if you don't get what you want? This depends on the contract. Is the contract adequate? Did the contract specify exactly what you wanted? If so, there are methods used to assure satisfaction in contracts, such as liquidated damages, maintenance bonds, and performance bonds. Discuss these and other techniques with your municipal solicitor before you write your specifications and contract. Make sure that you build protection into your contract before awarding it.

RTAP, Moving Forward Newsletter, January 1987, Vol. 4, No. 3.

NACE SEMINAR EXAMINES COMPUTER USE FOR COUNTIES

Computers and computer software were a prominent topic at the recent National Association of County Engineers' (NACE) meeting, recently held in Orlando, Florida. A formal session, Office Automation for Today's County Highway Department, was moderated by Ruth W. Stidger, Editor-in-Chief, Better Roads. Panelists included Jack Dier, Superintendent of Pennington County Highway Department, Rapid City, South Dakota; Albert Prast, Systems Engineer, Orlando IBM office; Dennis Polhill, Vice President of Pavement Management Systems, Denver, Colorado; and Galen Stuwe, National Project Coordinator, MCS Group, Rapid City, South Dakota.

Why Computerize?

There is a real urgency for state, county and city highway departments of all sizes to computerize, Dier said, speaking to the group. And, it costs

money to not computerize, whether the highway engineer realizes it or not. Dier's department started using the County Highway Resource Information System (C.H.R.I.S.) more than three years ago.

The makeup of Pennington County is especially interesting, because it points up the fact that an average county can use computers profitably. The county has 900 miles of road—one-third of that is asphalt and two-thirds gravel. There are 212 bridges. There are 2800 square miles within Pennington County. There are 40 employees—37 in the crew and three in the office, including Dier (three three do all of the work with the computer system). There are 115 pieces of equipment, and the budget is \$3.1 million.

Dier opened his remarks with a theme that continued throughout the session: just being an engineer or a superintendent is not enough. County engineers must be managers, Dier said, and this is their most important responsibility. Computers can help in this task of managing personnel, equipment and funds.

"Every day that [highway departments] are on a manual system," Dier said, "I am convinced that they are losing money."

Computers help prevent errors in reports, allow much faster handling of numbers (hours rather than days), and ensure that costs and other information is available when needed. Payrolls, job costs, and equipment costs used to take four to five days per month in Pennington County, Dier says. With computers, they take about 2.5 hours.

C.H.R.I.S. allows costing by job, by phase; by road; by bridge; by piece of equipment. Management reports are essential, too, Dier says. The system shows job costing (labor, material, equipment rental) for each project (road, bridge, and so on). Overhead costing is done in seconds with a computer. Budget reports allow immediate access to information about budgeted amounts of money spent and funds remaining. In the use of gravel, for instance, Dier says that daily costs of labor and equipment are immediately available using the system. Dier also shows daily how many tons of gravel were placed on specific road, per mile.

Engineers should try to not to be afraid to computerize, Dier says. He learned how to operate a computer for the first time when the system was installed. "Operating a car is more difficult than operating a computer system," Dier said.

Selecting Systems

Albert Prast, IBM, gave some parameters for selecting computer systems. Hardware, software, and service and support are the three areas to evaluate, Prast said.

In choosing hardware, important factors are whether it will run needed software and make the desired interfaces with other hardware. It must also have adequate storage.

In evaluating software, Prast said, consider the system's operating software—will it allow you to run needed application software? MS-DOS is fast becoming the standard system for micros, for instance, and much software is based on this operating system.

Service and support evaluation factors include need of repair, in-office repair availability, and costs. On-site training and continued education could also be considered.

Pavement Management Systems

Eventually, there may be an integration of a pavement management system, an office accounting system, and an equipment maintenance management system, so that data used to operate each segment can feed into the other programs. If such a system evolves, it is almost certain that Dennis Polhill and Pavement Managements Systems will be a part of it. The company is probably the only one marketing pavement management software that makes its entire business pavement management. A high ratio of engineers who daily work on pavement management projects ensures that the company's software is based on in-field experience.

To evaluate a pavement management system, Polhill told NACE seminar attendees, it is first necessary to remove yourself from the promises that are made by software suppliers.

Instead, for each area of work concern—pavement management or any other area—try to think about cost versus exactness. Every management decision comes down to that, Polhill said—cost versus accuracy. This can be applied to each element of a pavement management (or other) software system. For example, take structural testing. It is possible to make 10 tests a mile, 100 tests a mile, or 1,000 tests a mile. The more that are taken, the greater the accuracy. But, Polhill said, you must weigh the costs—deciding how much accuracy you can afford to have.

Implementing Automation

Computerization allows the county engineer to manage taxpayers' money responsibly, Galen Struwe, MCS Group, said. MCS is also interested in forming the vehicle maintenance, office automation, pavement management software link. Billions of dollars are managed by county engineers. But, when you talk about this money, and the way it's been managed, it's time to look at something new, Struwe said.

Elected officials should be made aware of the consequences of management with irrelevant information, Struwe said. A county software program must be a program that operates as C.H.R.I.S. does—full integrating fund accounting and job costing. Very few such programs exist, Struwe said.

"A lot of departments try to do it themselves," Struwe said—using a local programmer to adapt a general program. "Some departments take two or more years to convert a program that still may not work right. These packages may almost fit," Struwe said, "but this is not enough."

Questions focused on the county engineer's control of hardware, to allow use of desirable software, and the virtues of stand-alone systems versus those that are integrated with computers completing other county (non-highway) functions. Some participants favored high department autonomy, while others wanted integration.

Perhaps the answer goes back to Polhill's rule for decision making—measure cost versus effectiveness. If a specific software package will provide enough effectiveness, when software and needed hardware costs are measured, then that extra hardware cost (for an additional system) may be justified.

Better Roads, March 1987.

EDITOR'S NOTE

This issue of TechTrans is the last one for 1987. It will be the last red issue for all of you who were wondering why this Yellow Jacket was publishing a newsletter on red paper!

This issue is significant for a second reason. The fall issue will be our last issue before our contract renewal. We think we have rendered a valuable service to you all and should be renewed for another year. Don't you agree? Please let Commissioner Rives know if you appreciate and support our efforts at the Technology Transfer Center.

You will notice toward the back of this newsletter that we have added new tapes to our videotape library. Please make use of all of our tapes. Frequently your selections are unavailable, but I will send what I can find!

We will hold our workshop on microcomputers in October. The specific dates for presentation in each district have not been determined at the time of this writing, so be on the lookout for a brochure or give us a call.

I hope to see you all there.

M. JOHN MOSKALUK
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PUBLICATION

The following publication is available free from the Technology Transfer Center:

Outdoor Testing of Reflective Sign Materials

by the U. S. Forest Service and FHWA

The report summarizes the results of outdoor testing of numerous test samples using different material combinations and application techniques. The purpose of the outdoor testing was to find a combination of materials and techniques which would produce a durable retroreflective sign that would remain in service for at least 7 years with little or no maintenance. Recommended combinations and techniques for such a sign are made in the report.

The report is intended primarily for use by State, county, and city traffic and highway engineering departments, sign manufacturing personnel, and others who are responsible for installation and maintenance of street and highway signs.

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Describe.

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Further comments-

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Describe-

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How can this service of the program be improved?

Further comment-

TRAINING (WORKSHOPS)

Have you participated in Technology Transfer workshops?
Yes ____ No ____

Have others in your agency participated? Yes ____ No ____
Who?

Have the workshops been of value to you and your agency?
Yes ____ No ____

Describe-

Based on your experience, what are your comments or
recommendations regarding:

Workshop location-

Frequency, size and/or location-

Subject Material-

Other subject areas for workshops you consider
important--

Your suggestions for revised format to better serve your
agency-

GENERAL SUBJECT AREAS FOR DISCUSSION WITH SELECTED
INDIVIDUALS AS APPROPRIATE

1. Technology Transfer Program -- are locals aware and familiar with the program? Also, the roles of Federal, State, and T2 Center?
2. Innovative ideas relating to improvement of the Program and its ability to provide needed services.
3. The local feeling regarding the Program and the relative importance of the four services (Newsletters, Assistance, Materials, and Workshops) being provided.
4. Suggestions regarding evaluation or measurement of the Program's values to the locals.
5. Neglected activity areas in which the center could or should be involved.
6. The need for locals to react to the Program. The Federal, State, and the Center needs local response to the specifics of the Program.